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Appraisal and Control
of
**DUPLICATING
SERVICE**



*Management
Bulletin*

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**EXECUTIVE OFFICE OF THE PRESIDENT
BUREAU OF THE BUDGET**

Let's Limit Our Terms

In the broad sense the terms *printing*, *duplicating*, and *reproduction* mean pretty much the same thing. In a narrower trade sense, however, an important distinction is often intended. The term *printing* is commonly applied to certain multiple-copy-making processes as they are customarily used in the printing industry. The terms *duplicating* and *reproduction* (and even the wide-open term *processing* itself) are commonly applied to some of the same processes, and to several others, that have been adapted for use in business offices and letter shops as comparatively small-scale substitutes for regular printing-industry processes.

To avoid the pitfalls of definition at this point, let's just say that this bulletin is about duplicating, or reproduction, in that narrow trade sense; and, although duplicating and printing have processes and problems in common, we do not expect the bulletin to be a fully suitable guide to the appraisal of shops that make general use of movable type, type-setting and plate-casting equipment, regular relief printing presses, large offset presses, or other equipment typical of the printing industry. What we are aiming at here is the great majority of shops that use processes like hectographing (as by Ditto), stencil duplicating (as by Mimeograph), office-offset printing (as by Multilith), office-rotary-relief printing (as by Multigraph), and photo-copying (as by Photostat and Ozalid).

Let us point out, however, that much of the work referred to here as *duplicating* or *reproduction* falls within the meaning of the term *printing* as currently defined by the Congressional Joint Committee on Printing. In fact, we assume that, for purposes of reporting to and dealing with the Committee, most of the duplicating shops in the Federal Government will be considered either class A or class B printing plants, and that all officials having responsibility for such duplicating plants are familiar with the latest regulations of the Committee.

For a brief explanation of the processes commonly used in agency duplicating shops, and for further distinction between printing and duplicating practices, please turn to the centerpiece and appendix to this bulletin.

APPRAISAL AND CONTROL of DUPLICATING SERVICE

Preface

Quality of finished work, reliability of service, economy of operation—these values are hard to get in agency duplicating activity. They are just as easy to lose if you once have them. Yet, in several ways they have a bearing upon the success of any agency's program.

An agency—let's say your own—can assure consistent quality, reliability and economy in its duplicating only if—

- (1) You who are in management systematically control and coordinate the demand for service, and maintain facilities only for those necessary processes that cannot be as efficiently provided by other sources; and
- (2) You who are the users of the service properly prepare and requisition the work to be reproduced; and
- (3) You who are duplicating supervisors appropriately control and schedule the operations—the men, machines, and materials—within the shop; and
- (4) You, the management again, regularly review some valid index of results and occasionally require a more searching appraisal of the whole activity.

The last of those conditions, review and appraisal, cuts across all of the others. It is that review and appraisal, the sizing-up process, with which we are chiefly concerned in this bulletin—how you can take a cut through the duplicating activity as a whole and tell whether management conditions, both inside and outside of the shop, are right for high quality, reliability, and low cost.

We cannot prescribe any one standard organization or procedure for the duplicating activity of all agencies; the problem is too varied for that. We do not offer a set of Government-standard production quotas, unit costs, and break-even quantities for the various processes and classes of work involved; the necessary data just are not yet available for

such precise standards. Based on many surveys in both Government and non-government shops, however, we do attempt here to do three things:

- (1) To outline the main points to consider in appraising duplicating under varying agency circumstances;
- (2) To suggest ways of getting the information needed both for occasional appraisal and for regular control; and
- (3) To compensate for the lack of quantity, quality and cost standards by discussing practices that may be considered adequate, within broad limits, and by pointing to steps that can lead to actual standards.

We hope it is clear that the specific records and forms shown here—and more especially the procedures—are not offered for use as they stand. Since they are of a composite nature, these records and procedures are not likely to fit any given agency exactly. They would need to be considerably simplified for the very small shop and possibly supplemented for the very large.

We have not tried to give complete instructions on such broad topics as production, quality and cost control. Of those topics we have tried, instead, to highlight the aspects which have special bearing on duplicating work or which seem to need interpretation in terms of that work. The more general aspects of these special fields are treated elsewhere, and in any event are beyond the scope of an appraisal guide such as this.

Nor do we deal here with shop-operating methods. The emphasis is on supervisory control and management evaluation rather than the performance of duplicating processes.

We have tried to present the material so that it will be helpful to duplicating shop employees and to all those making use of their services. Our main purpose, however, has been to make the guide readily useful to (1) organization and methods analysts who are called upon to survey duplicating activities, (2) shop supervisors interested in sizing up their own control practices, (3) administrative-service chiefs or others under whose general direction duplicating may fall, and (4) executive officers or other “business manage-

ment” officials who, together with administrative-service chiefs, should pass judgment upon existing duplicating services and determine from time to time whether to expand facilities or retrench, retain agency-operated facilities or discontinue them, install facilities or renew contracts for outside service.

Because all of those persons are not likely to be equally interested in all the details treated here, we have tried to distinguish between the broad considerations upon which the general administrative official must act and the more detailed findings with which an analyst, service chief or supervisor may be concerned, either to help the general executive reach a decision or to economize and improve the service to the extent of their own responsibilities. Accordingly, in the first chapter we have treated the problem in general terms, as it relates to program goals and to other problems of agency administration; and then we have designated portions of remaining chapters which, along with the first, may be helpful to those not interested in details.

And, let us explain, we have taken some pains at this point to tell you what is in the bulletin so that you won't waste time looking for what is not there.

For their cooperation in developing and reviewing the subject matter, we are especially indebted to officials of the Agriculture, Commerce, Justice, Labor, Navy, Post Office, and State Departments, and the Federal Security Agency, Federal Works Agency, and the Government Printing Office.

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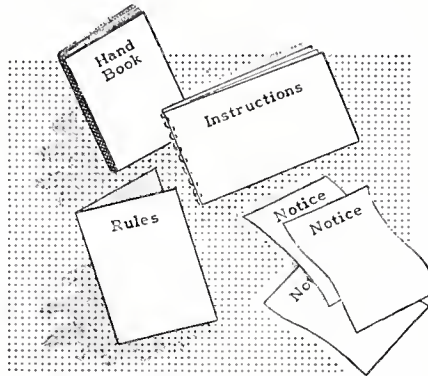
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I. MANAGEMENT'S INTEREST IN DUPLICATING SERVICE



The chances are that the only contact which most people have with your agency, and in fact the only contact which most of your agency's employees have with their own headquarters, is by reproduction of the written word. The results of this important means of contact depend upon the appearance and legibility of the reproduced work, and at least equally upon its dependability—its timely delivery from the shop.

Appearance and readability help to determine how the public reacts to your reports or your rules and regulations. Many tests have shown that, whether reading matter is actually read or only casually seen, its appearance usually leaves an impression, favorable or unfavorable; and that the extent of actual reading increases with the suitability of appearance.

Legibility affects the reading time and the understanding—hence the efficiency—of all employees who must rely upon duplicated reports and instructions in doing their daily work.

Dependability in the timing and issuance of duplicated materials affects agency activities in several ways; for program priorities, operating deadlines, outside commitments, conference schedules, action dates of many kinds, often can be no firmer than production timing in the duplicating shop.

What Are the Pitfalls?

To most Government officials duplicating is, and should be, just one of the several administrative services to be drawn upon as necessary—taken for granted, like the lights in the office. Yet, perhaps

because it is taken for granted, wasteful production practices, delays, and lapses in quality have a way of creeping in, accumulating and becoming accepted as normal.

The service may be indiscriminately used and production processes for specific jobs poorly chosen. Finished work may be generally poor and illegible, the major cost of research and writing being partly wasted by failure to add the minor element of presentability; or the finished work may be generally overelaborate and distracting to the reader. Priority jobs in the shop may continually disrupt and add to the cost of normal production; or, though quality and unit costs may be good, unimportant or unneeded jobs may constantly get in the way of urgent needs.

Besides their direct impact on agency operations, these inadequacies detract indirectly by absorbing funds that should go into program activity. While most administrative services are subject to this hazard, duplicating is especially so. Because duplicating is so closely tied into the whole agency program, its cost usually is met out of general operating allotments and not charged against the specific offices having the work done. Stencils or master copies to

be reproduced usually are typed outside the duplicating shop. Costs are thus diffused and total expenses for the duplicating activity as a whole, unlike printing and binding costs, are hard to pin down.

Yet, page for page, duplicating is generally thought to be much less expensive than printing, as in fact it is for many classes of work within certain quantity limitations. Possibly it is because the service usually is known to be convenient and assumed to be cheap that the demand for it has a way of expanding to the capacity of whatever facilities are available or to the limit of whatever arbitrary restriction may be put upon their use.

Considerable technical knowledge often is necessary to decide which duplicating process will produce a given piece of work in required quantity and quality, within necessary time limits, at lowest cost. Because of constant technological advances, the right decision one day may be wrong the next.

Several circumstances, thus, add up to the fact that complete freedom either in the use of duplicating service or in the specification of process can be an open invitation to unnecessary cost as well as unsuitable work. The same is true of the choice between printing and duplicating.

Why Size it up?

Commercially, duplicating is a highly competitive business. The competition itself undoubtedly enforces modern measures to keep costs down, quality and service up. Without the rigid disciplines of profit-and-loss competition, duplicating shops in the Government have to get their stimulus for efficiency directly from agency management. Management, with its many other responsibilities, can hardly provide that stimulus unless it has a regular and convenient way to take the measure of this activity—to size it up against what it ought to be.

In fact, your agency should consider any duplicating facilities of its own to be in direct competition with all others available—both governmental and commercial—that are suited to the work in question. The agency should have complete facts by which to compare its own costs and services with those outside; and if it cannot maintain a favorable comparison, it should eliminate facilities in favor of contract work.

Even though your agency may not do its own duplicating, someone has to make day-to-day decisions on what and how much to have duplicated,

where and by what means to have it done; and someone should make an examination from time to time to see that program needs are being properly served at costs that are not only reasonable but below those which the agency would have to meet if it provided its own service.

So whether your agency operates its own reproduction facilities, gets its service on contract from another Government source, uses outside commercial service, or meets its needs by a combination of these means, appraisal and control are necessary to avoid the penalties of poor quality, unreliable delivery, and high cost.

The problem of appraisal differs, however, according to the extent to which the agency supplies its own service.

Approach to Appraisal and Control

To evaluate the whole duplicating activity at any given time, you face three main questions:

1. Are Work Screening and Process Selection Adequate?

Whatever the source of service, are your requests for printing and duplicating being sifted and followed up so that—

- (a) only essential work is either printed or duplicated?
- (b) the right decision as between printing and duplicating is made in each instance?
- (c) appropriate materials and processes are specified in ordering?
- (d) priorities applied to competing requisitions are in line with agency program priorities?
- (e) steps are taken to see that delivery dates and quality standards are met?

2. Are Existing Sources of Service Justified?

Could you get better service at less cost by discontinuing all or part of any duplicating operations within the agency and using the services of another agency or a commercial source? Or would you get both better service and lower cost by doing in the agency certain operations which have been done outside?

3. Are Quality, Speed, and Unit Cost Adequate?

If you operate your own shop, is performance good in terms of quality, speed, and unit cost; and if not, from what direction should improvement be expected?

All of those questions must be answered in any complete appraisal. Determinations as broad as

these, however, can only be made by first finding the answers to many smaller questions.

If a suitable control system is being used, reproduction supervisors can answer most of the questions at any time, and periodic reports will summarize the more important facts for regular management review.

Without such control, special surveys are necessary to get at the facts; and even with controls, an occasional survey is needed for more thorough evaluation, as well as for checking the controls themselves.

Whatever special fact gathering and analysis is needed for topside appraisal, it should be done, if possible, by a disinterested person outside of the supervisory line to the duplicating shop. Whatever his normal assignment, his function during the study should be that of an organization and methods analyst. If he has a broad and up-to-date knowledge of duplicating practices, in addition to qualifications as an analyst, so much the better. In fact, if the size of the agency and the amount of its duplicating justifies it, some one person in the organization and management office (or similar staff group) should be given continuing responsibility for keeping posted on developments in the duplicating industry and for applying the knowledge of such developments to the analysis and improvement of duplicating activities within the agency.

Where to Get the Facts Needed



On the question of screening and process selection, a review of the shop log, or register of work received (fig. 8, ch. VI), and a detailed examination of a random selection of completed requisitions (fig. 2, ch. IV) and work samples should give the information needed. Considered in terms of the agency's program, organization and clientele, the register will give quick clues concerning appropriateness of materials duplicated, processes used, quantities run, time required for delivery, and volume of output. The requisitions should give complete specifications, order dates, delivery dates and per-

haps costs, for specific jobs. The work samples will show quality of results. As a further aid in checking the appropriateness of processes chosen for the individual jobs, a chart of processes and their ranges of economical use (such as the Guide to Reproduction Methods, centerpiece exhibit B) should be helpful.

On the question of what facilities are justified, a study of the register and of requisitions completed over a fair period again should be useful by showing the amount of work done by each process and the promptness of delivery. But to find out more accurately how fully each type of equipment has been utilized, or to what degree it has not been equal to the demand, production reports (like fig. 9, ch. VI) are needed.

In addition, comprehensive cost information must be obtained. To the extent that the agency operates its own facilities and has adequate cost control, the needed information should be available in summary, or should be especially compiled, as suggested in chapter VII. To the extent that the agency uses outside services, the costs of substituting agency operations should be estimated in terms as nearly comparable as possible and supplemented by a statement of outside services actually available. As a basis for further comparison, then, a statement of costs in a representative sample of other agencies and private firms should be compiled if possible.

In any question of opening new duplicating facilities within the agency, the advice of authorities on the subject from outside the agency should be sought.

On the third main question, adequacy of quality, speed, and unit cost, the same facts may be sufficient: work samples to show quality, the register or completed requisitions to show elapsed time, and periodic reports when possible, to show unit costs and actual output as compared with potential. If wide fluctuations in output and time, or inadequacies in quality or cost, are indicated but not identified or explained by such information, additional facts should be obtained, either from supervisory control records kept in the shop or by special survey.

What About Records?

An adequate control system ordinarily requires the use of such records as those outlined below. We have mentioned some of them (above) as sources of appraisal information. Because the details of control procedure can and should vary, the purposes

and uses of the records are treated more fully, but without regard to procedural sequence, under the various subject headings in the chapters that follow. But in order to draw the major threads of record use together at one point and to emphasize the kind of interrelationships to be dealt with, certain procedural assumptions are made here. The main point is that the records kept should form a pattern consistent with operations and keyed to management control. The pattern is the thing to look for, rather than any specific number or design of forms. The forms themselves can be consolidated and simplified or expanded and supplemented as circumstances require, so long as key facts are kept and controls applied.

1. **REQUISITIONING.** The office wanting work reproduced prepares a **REPRODUCTION REQUISITION** (fig. 2) in triplicate or quadruplicate, as explained in chapter IV under *Requisition for Service*. Retaining the fourth copy, if four are used, that office sends three copies to the office of the duplicating shop supervisor.

2. **REGISTERING.** In the office of the shop supervisor a job number is assigned and the job registered; that is, certain key data, such as date and time received, type of job, quantity ordered, processes called for, delivery date, and the job and requisition numbers, are entered on a line of the **REGISTER OF WORK RECEIVED** (fig. 8), as discussed in chapter VI.

3. **SCHEDULING.** Still in the shop supervisor's office, production for the job is scheduled. A separate **DAILY PROCESS SCHEDULE** sheet (fig. 7) is maintained for each regular shop process or operation, whether manual or mechanical, as discussed in chapter VI under *Work Scheduling*. Each sheet shows potential production for a specified process on a specified day. As a new job is scheduled, the number of work units requisitioned is deducted from the balance of potential production for each process called for by the job, thereby showing at all times the commitments already made and those that can still be made for each operation in the shop.

4. **DISPATCHING.** One copy of the requisition is filed by job number in the shop's work-in-process file; and one is returned to the ordering office, showing the job number. The third copy—scheduling and processing instructions having been added—is forwarded (with stencil, plate, or other master attached) to the appropriate work section or unit of the plant, to accompany the work through to completion. See chapter IV under the heading *Are*

Requisitions Right for Efficient Service and chapter VI under *Dispatching*. At the section or unit level, an informal record may be kept showing the work station to which the job is assigned, the date, and the time. If processing is required at more than one point, a similar notation is made each time the job moves (unless the plant is so small that this record is not needed at all).

5. **INSPECTING.** In addition to appropriate spot inspections and machine set-up approvals during processing, the completed job is inspected, as discussed in chapter VI under *Quality Control* and the job copy of the requisition initialed accordingly.

6. **DELIVERING.** The time of delivery is entered upon the **REGISTER OF WORK RECEIVED** (see step 2 above) and a receipt signature obtained on the third copy (job copy) of the requisition, which is then filed (along with or in lieu of the original) in the completed work file.

7. **PRODUCTION TALLYING.** Each operator (or his supervisor) keeps a running tally of output and time spent on each process or operation to which he is assigned. A separate tally for each operator (or machine) and for each manual worker (or manual process) is submitted to the plant supervisor's office each day, as discussed in chapter V. In addition, special reports on machine and paper utilization may be needed from time to time, as explained in chapter V.

8. **PRODUCTION POSTING.** Data from each of the above tallies are posted chronologically to a separate running record, **MONTHLY RECORD OF DAILY PRODUCTION** (fig. 4), to show each day's output for each process or worker over a monthly period, as discussed in chapter V under *Manpower Considerations* and in chapter VI under *Production Standards*.

9. **PRODUCTION REPORTING.** From the above process-production records and the process-schedule sheets an over-all **MONTHLY PRODUCTION SUMMARY** for the shop is derived (fig. 9), showing total man-days and output as against the scheduled potential for each process, and showing such other facts as the amount of work behind schedule. See chapter VI under *Production Standards*.

10. **COST REPORTING.** A reproduction cost report is compiled periodically or on special request to show element costs, total cost and unit cost for each process, as discussed in chapter VII.

Ordinarily only the **MONTHLY PRODUCTION SUMMARY** and the cost report require attention above the level of shop supervision. Other records, or

special studies in lieu of them, need to be looked into by general administrative officials or staff analysts as production or cost reports show conditions requiring more detailed information, or as changes in organization, program or other conditions suggest the general reappraisal of duplicating service.

How To Use This Bulletin

The three chapters following this one discuss the factors to be considered in deciding what, if any, reproduction operations should be conducted within the agency, whether organization and coordination within the agency are good enough for efficient duplicating service, and whether the means of clearing and screening reproduction requests are sound. Because such questions call for decision at a high level, major portions of these chapters, together with the discussion of *How To Put Cost Data to Work*

in chapter VII and the *Check List*, chapter VIII, should be useful to those at the top level of internal agency administration (executive officers, assistant directors for business management, chief budget and control officers).

The remaining chapters discuss the appraisal of such technical devices as production, quality and cost control, as they should be found in well supervised reproduction operations. These are the basic operating controls which make higher-management control possible.

Intermediate levels of administrative management, analysts acting on behalf of management, shop supervisors, and to some extent operators in the shop, should find all of those chapters a source of guidance in appraising duplicating shop performance or in supplying top management with facts needed for its decision.

II. WHAT DUPLICATING SERVICE DO YOU NEED?



Duplicating services are available from the Government Printing Office, other Government agencies, and a variety of commercial plants. Because these sources of service are many, you may well question the wisdom of your agency's operating its own facilities.

Whether the question is to set up, to continue, or to expand reproduction operations, however, don't overlook the burden upon personnel, procurement, budget, and fiscal offices, or any of the indirect costs of space and utilities. These considerations are especially important if the question is between having some facilities and none at all; somewhat less important if the question is only one of how large an operation—or what specific processes—to maintain.

Is Self-Service Warranted?

In judging the need for agency-operated facilities, consider such factors as these:

- (1) **The cost of self-operation as against that of using other services;**
- (2) **Necessary speed of service;**
- (3) **Any unique requirements in the nature or quality of work;**
- (4) **Any need for especially close coordination between reproduction and agency distribution channels, or need for reproduction as a step in a continuous flow of work; and**
- (5) **Security requirements of material being reproduced.**

All of these considerations may have a bearing upon your agency's program or you may find any one of them to be the controlling factor.

Cost advantage

The most common justification for agency-operated facilities is the ability to produce required work more economically than competitive sources. You probably can have no better justification than economy, when and if you can back it up. You cannot back it up, however, unless comparable cost figures are available. We'll examine cost factors more fully in chapter VII.

Necessary Speed

You may find it hard to fit work into the production schedule of a shop outside your agency and get the same speed of service that you might get in your own shop under your own priorities. The very nature of the program in some agencies makes a large amount of rush work unavoidable and certain self-operated facilities necessary. We have found, however, that often the unusual speed demanded at the duplicating stage of issuing a document could have been avoided by better scheduling in the research, writing, and editing stages of the work. Developmental research and writing may have taken many months, and yet reproduction may be demanded in a day. Often, too, rapid service is specified on the requisition just as a matter of course, with the ordering office neither needing the early delivery requested nor realizing that the request may be disruptive and needlessly costly. In the next two chapters we will touch upon organization and control considerations that are pertinent in this connection. In any event, if a number of outside sources are available, do not assume that no outside shop can give sufficiently prompt service just because you find that one shop cannot. Most duplicating plants can give emer-

gency service when the occasion demands. Bear in mind, however, that no shop—in the agency or outside—can schedule rush work economically. Either such work must be done outside of the regular schedule at extra cost, or scheduling and the efficiency and economy that go with it must be abandoned.

Unique Quality Requirements

It is possible that your agency may regularly require work of a specialized nature or of a peculiar quality not obtainable from any reasonably accessible outside source. Again the question—Is the special quality actually a requirement? Is it a program necessity? Will a more common grade of work serve as well? Can substantially the same results be obtained by a more common process? Have recent developments in duplicating methods altered the original findings?

Procedural Requirements

You may possibly find that the production and distribution of certain duplicated working papers require such close and constant coordination with the reproduction shop that agency-operated facilities for at least the regular routine work may be the only answer. In fact, the efficient performance of certain paper-work procedures may require the actual integration of routine single-purpose duplicating processes. The savings to be gained by eliminating interruptions, extra handling, hauling, counting and back-tracking, may far outweigh the cost of maintaining the isolated duplicator needed to make a continuous, straight-line operation possible. You will find that careful analysis is necessary for making sure that such an arrangement will pay its way, and you will find reappraisal necessary from time to time to see that changes in program or operation have not eliminated the need for any special installation of this kind. (See ch. III for consideration of centralized versus decentralized facilities.)

Security Requirements

The handling of secret or confidential copy is a matter of serious concern. Most agencies should be able, however, to get as rigid an application of security restrictions in the duplicating shops of certain other agencies as in their own. Classified documents are regularly handled by the Government Printing Office and, as a matter of fact, by many commercial plants. There are circumstances requiring more caution, but they are unusual as the only grounds for agency duplicating facilities.

What Processes Will Pay Off?

If on the basis of the above factors you have found that some kind of self-service is necessary, you still face the question of what specific processes and auxiliary operations are justified.

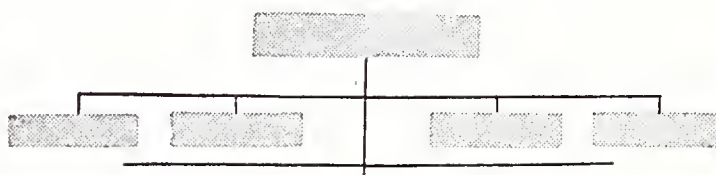
As the first step in answering that question, find out how much work your agency requires by each process. For work done in your own shop, you should find data on this point in production reports (as in fig. 7); or you can accumulate the information by reviewing process schedules (fig. 7), the register of work received (fig. 8), or completed requisitions (fig. 2). In any event give careful attention to a sample of completed requisitions to see if economical choices of process have been consistently made. If wrong selections of process have been common, allow for that fact in estimating future needs. (See centerpiece exhibit B, *Guide to Reproduction Methods*.) The same yardsticks of service, quality, and cost that you applied in questioning the need for self-service in the first place you should now apply to each process for which you find enough work to warrant consideration.

The manpower and overhead necessary for one process may be ample—or nearly so—to maintain still other processes. If so—and assuming the first process to be necessary—you may well give serious consideration to processes which, standing alone, might be out of the question.

Be careful, however, to see that auxiliary equipment is not maintained merely because a basic process is needed. For example, even though an offset duplicating machine may itself be fully justified, a photo-offset camera and plate-making equipment may not be. If photographic plates are needed only now and then, you may find it much more economical to have them made elsewhere rather than maintain expensive, underutilized plate-making equipment and staff.

Because of changing conditions within the agency, as well as constant developments in duplicating technology, the entire question of what processes to maintain requires periodic restudy. The study should include a thorough analysis of all classes of work produced, a reappraisal of need, a reexamination of comparative costs, and a review of service available from other sources. Such detailed study should be in addition to the less detailed review of the question made regularly as a part of your continuing control program.

III. IS THE ACTIVITY ORGANIZED FOR SERVICE AND ECONOMY?



Just where reproduction facilities are placed within the organization and how well those facilities are coordinated with other staff and service functions have a real bearing upon the agency's ability to turn out quality work geared to program needs.

Should Facilities be Centralized or Scattered?

Consider first the comparative advantage of consolidated service as against the operation of scattered equipment. Experience has brought no hard and fast rule on this point. Rather, you will need to review your own situation objectively and reach a decision on the merits of the case. In making your inquiry, however, you will want to consider certain generalizations.

Ordinarily the concentration of production at a central point results in a production volume great enough to justify a wider selection of processes, page sizes, type styles, paper, ink, copy-preparing services, and bindery operations than smaller scattered operations would warrant. These, together with the increased specialization and improved technical supervision warranted also by greater volume, make possible a higher quality and wider range of finished work. In addition, greater volume—as long as it is within manageable limits—brings opportunities for economy through better stabilization of work load, fuller utilization of personnel and equipment, and better stock and supply practices.

The disadvantages of consolidated operation may be twofold: (1) the work from any one "customer" must be woven into a production schedule along with the work of others and may not always get the same prompt attention that self-operated on-the-spot facilities can give; and (2) the program administrator or line operator is remote from the

responsibility for plant efficiency and its effect on his program. These disadvantages can be overcome, however, by effective scheduling and control.

In considering decentralized facilities, the factors to examine are much the same as those to review in considering the feasibility of having any agency facilities at all or in considering what specific processes to maintain. The emphasis here, however, is more likely to be on the need for the procedural tie-in of single-purpose reproduction operations. Otherwise, in the absence of unusual volume, small isolated units are seldom warranted.

If you find that scattered operations best serve your agency's needs, you probably will still find it wise to maintain centralized functional responsibility for the facilities. In general, the concentration of this responsibility in as few hands as possible permits greater uniformity of practice and better use of workers, equipment, and supplies than are otherwise possible. In any event some centralized management control of scattered operations is needed; and records consistent with those illustrated in this bulletin should be kept for that purpose.

How About Coordination?

To whatever extent facilities may be consolidated or scattered, close coordination with program units, with the budget office and with administrative-service units is essential.

A function which we will take up in its own right in the next chapter, but which is pertinent

here as a matter of coordination, is the determination that specified written matter should or should not be reproduced, or that specified duplicating processes should or should not be used for the purpose. While the primary determination ordinarily must come from the program administrator affected, in many cases the funds available cut across bureau or division lines, and questions of priority have to be resolved before certain requisitions can be honored. Though often left to administrative-service officials, the resolution of such questions is more commonly recognized as needing joint consideration by program, budget, and duplicating-shop people, perhaps by means of a clearance committee. Representatives of those interests, whether as a committee or not, should normally pass on such matters as advance planning and cost, and on standards for the use of graphics, sizes and grades of paper, quantity, process selection and distribution, as well as questions of priority and authorization of issue.

By such working relationships, those who plan and prepare major documents to be duplicated should be kept aware of work-load trends and peak-load periods in the duplicating shop and should take every reasonable step to schedule and feed their material to the shop accordingly (to make stabilizing and balancing of work-flow easier).

The need for close coordination of duplicating service with the purchasing office and supply room and with mail and messenger service is apparent; dependability of reproduction service may suffer directly from deficiencies in any of those services.

Working relationships must be clearly established also with the agency's forms-control activity.¹

Perhaps equally important, arrangements should exist whereby organization and methods analysts or similar staff are kept abreast of advances in duplicating technology so that they can be drawn upon for competent advice and special studies of plant organization, operation and management.

Even though a committee is maintained for the purposes mentioned, it will not be able to act as a body in screening and coordinating day-to-day requisitions. The burden commonly falls by default upon some one member—perhaps the chairman or secretary—of the committee. It is usually wise, therefore, for management to designate a publications control officer (or unit) within the organiza-

tion and management office or elsewhere within the general management staff. That officer can serve as the working chairman of any publications planning and policy committee that is maintained. Also, although individual clearance is not necessary for certain classes of work, that officer can be the screening point for those classes that do require clearance. To the extent that requisitions and copy have not been adequately cleared before reaching him, he can check with such budget, information, program, and policy officials as he finds necessary on the basis of established ground rules. He may or may not be staffed to give detailed editorial assistance; but, in addition to assuring proper clearance, he can see that publications and other official issuances meet agency standards of style, form, and identification. He can keep track of issuances in relation to the agency's work program. He can notify the information officer of publications likely to have news value, and can otherwise cooperate with that officer to be sure that official issuances are coordinated with public-information activities, and to see that the public-information aspects of such issuances get proper attention. He can see that work is properly requisitioned in terms of materials and processes. He can bring exceptional cases of any kind to the attention of the committee.

Who is Responsible?

As you might expect from the points of coordination mentioned, experience has shown that centralized reproduction facilities usually should be located in the administrative-service area, and that the centralized functional responsibility for any scattered facilities ordinarily should be similarly placed.

In other words, while the size of the agency and the size and importance of the reproduction service have a bearing on location, the plant supervisor is usually responsible to the same administrative-service official who directs such activities as telephone service, mail and messenger service, graphics (when a separate entity), and administrative supply service. At any rate, the line of responsibility from the reproduction plant, as a rule, should lead to that official; working relationships with budget, organization and methods, and program units should be clearly drawn; the plant supervisor should be available to advise customer units in the planning of work; and *these arrangements should be included in written instructions for all to see.*

¹ For additional discussion of the relationship between duplicating and forms control, see *Simplifying Procedures Through Forms Control*, a Bureau of the Budget Management Bulletin, June 1948.

Organization Inside the Shop

The usual plant is subdivided (organizationally, if not physically) into an office of the plant supervisor and as many units or subunits as the volume and flow of work and the variety of processes may make necessary.

The supervisor's office usually is responsible for the receipt, recording, and review of requisitions; the checking of any questionable process, paper, or quantity specifications; the assignment of jobs to the processing units; the provision of technical guidance to plant personnel; the scheduling, follow-up, inspection and control of work to assure prompt service, maximum quality, and minimum waste; the continuous appraisal of manpower, equipment, and general plant efficiency; the maintenance of production and cost records; and the provision of advisory service to line or program officers for purposes of advance planning.

For good supervision and division of work, subunits usually are maintained on the basis of related operations and skills. These groupings vary according to the size of the shop, the number of different processes carried on, and the volume of work in each process. In shops offering all the more common processes, the subdivisions usually include: administration; composing or copy preparation (on stencils or other masters); offset plate making and other photographic processes; duplicating-machine operation; bindery or finishing operations; and possibly addressing and distributing.

If warranted by volume and the need for leveling out and balancing the work flow, copy preparation may be divided again into a subgroup for drawing-board or "scope" work and one for machine work on Vari-Typer or electric typewriter. Similarly, platemaking and photo-duplicating may be split. Machine operation may be subdivided by type of machine (as a stencil-duplicator group, hectograph

group, and offset group), with each machine subunit having a fully qualified operator or group leader for set-up work and supervision, aided by semiskilled (or unskilled) machine tenders. Volume bindery operations may be subdivided into such subunits as cutting and punching, collating and gathering, padding and stitching.

Relatively fine subdivision of the work offers the advantages of spreading scarce skills, utilizing a greater proportion of unskilled workers, sharpening unit skills, increasing productivity by specialization, simplifying the problem of classification, training, and promotion, localizing supervisory responsibility, and identifying management weaknesses. On the other hand, any overspecialization will make it hard to maintain an even distribution of work, with resulting waste of workers' time. It may also make the work less interesting to the workers.

One way to assure enough flexibility to cope with fluctuating demands on the various processes in the shop is to train specialized workers to do certain second-line duties as needed, keeping supervisory responsibility for specific functions fixed in specific units but shifting operating personnel from one unit to other related units on a supplemental basis. Even so, however, it is seldom wise to subdivide beyond the point at which workers are normally kept busy in their own regularly assigned (first-line) duties; fixed responsibility is important at the performance as well as the supervisory level.

To say the least, in appraising the efficiency of plant operation, it will pay you to analyze carefully the allocation of supervisory responsibility and the grouping of tasks as related to stability, flexibility, fixed responsibility, competent technical supervision, and skill utilization. The right combination of those conditions goes a long way toward quality, economy, and responsiveness to program requirements; and such a combination forms the basis for effective controls.

IV. IS WORK WELL PLANNED, SCREENED, AND ORDERED?



Two questions need to be answered before the reproduction plant is called upon for service:

1. **Is the proposed product essential to the agency's program?**
2. **If so, when and by what method should it be produced?**

At this point in appraising the duplicating activity, the object is to find out how well the agency is equipped to make these decisions. Do they flow naturally from logical organization assignments, fixed responsibility and commensurate authority, clearly written instructions, and proper training? If the right answers are not being reached, or if often reached only after misunderstanding and delay, what's the cause?

Here again we have not found a regular pattern by which you should expect to judge your own agency. But we can tell you about certain practices that are comparable among agencies having these problems well in hand, and we can mention factors that each has had to weigh in deciding on certain additional practices, even though the decisions have varied with the circumstances.

What Joint Planning and Administrative Clearance is Needed?

We have already touched upon the need for fixed responsibility in the clearance of duplicating proposals, and for coordinated review by program, budget, and technical-service officials. End use of the product, advance approval of general content, scheduling of production and priority of issue, cost, quantity, use of graphics, and means of distribution—these are among the matters which may call for varying degrees of joint consideration in deciding whether to reproduce or not, and if so by what process. Such considerations are *in addition to* any necessary *subject-matter clearance*.

The program official will ordinarily have reasonable authority to decide on the issuance of printed or duplicated materials needed to meet his responsibilities. In the budget-formulation process, how-

ever, all program chiefs should plan carefully enough for the duplicating and publishing needs of their coming work programs that the budget officer can stretch funds to cover essential reproduction without jeopardizing other agency operations by holding unnecessary amounts in reserve. In addition, the budget officer should be consulted from time to time during the budget year to be sure that any large or unusual documents to be reproduced will be realistic in terms of the budget. Similarly, the printing officer or duplicating supervisor should be consulted on such questions as the results possible by different processes, comparative costs for different quantities, the technical problems of reproducing graphic and tabular matter, and possible issuance schedules.

You should not find it necessary to have formal administrative clearance for all individual requisitions. Routine, repetitive classes of reproduction, such as agency rules and regulations, opinions and

decisions, administrative bulletins, and operating instructions, can be exempted on the basis of agreed-upon ground rules. Preapproved blanket specifications can be in effect at all times for such regularly recurring jobs, with a check-up from time to time to see that the specifications are kept in line with changing conditions; or the plant supervisor may be authorized to carry out administrative clearance as necessary on small routine jobs. Minor jobs in small quantities can also be exempted (as small runs by hectograph or photo copy for clearance purposes).

For all except such minor jobs and repetitive work, however, complete requisitions, with copy, should be cleared singly. In fact, for jobs of unusual size, kind, or cost, generally it pays to have the originating unit present a detailed prospectus for tentative budget and reproduction clearance before research, development, and writing are begun. You will find that the cost of duplicating is usually small compared with the cost of fact gathering, analysis, writing, substantive clearance, and revision needed to bring publications to the reproduction stage; and those costs should not be incurred without assurance that suitable publication will be possible.

As already mentioned, some one person (or unit) in the administrative management staff should be made centrally responsible for seeing that the necessary clearance and coordination are carried out.

Are the Right Processes Used?

Several agencies have charted the relative advantages of different reproduction processes for different classes of work. Such charts give comparative data for each available process on such questions as quantity limitations, speed of original copy preparation, reproduction speed, rerun possibilities, reduction and enlargement possibilities, writing quality of the paper that can be used, legibility and life of reproduced copies, and unit cost of master and copies. You will find that the use of such information by the persons responsible for planning and requisitioning reproduced materials will help them to choose the appropriate process in most cases and to see that copy is presented in a form consistent with the process, thus avoiding needless delays and misunderstandings, speeding up work within the shop, and contributing to better and prompter results at lower cost.

Centerpiece exhibits A and C show the selection charts used by the Navy and Labor Departments, respectively. From a study of these and many

other charts we have developed exhibit B, Guide to Reproduction Methods. The data in it have been verified for types of equipment now commonly used in agency duplicating shops. Although this chart pulls together a lot of useful information in handy form, it is necessarily in terms of rough averages. The chart used in your agency had better be based on your own equipment and your own production, quality, and cost experience.

You will recognize that, because improved equipment and accessories are being introduced constantly and because cost factors also change, any such chart must be revised now and then.

Are Requisitions Right for Efficient Action?

The duplicating requisition form itself should serve not only to convey specifications from the customer unit to the shop, but also to help the customer decide what those specifications ought to be. It should give reasonable assurance that essential details will not be overlooked in ordering. It should be constructed to serve the shop, then, in scheduling, control, and administrative reporting. It should be designed for ease of use, and standardized for time-saving uniformity.

The form should permit precise and convenient designation of quantity, process, composition, page size, paper (color, weight, grade), position of image on the page (front and back), margin requirements, ink color, assembly, punching, binding, and distribution. Those items, and the possible selections under them, should be arranged logically not only for making entries but for use as a check list, or guide, in consulting with the duplicating supervisor on questionable points.

Figure 2 suggests possible content and arrangement of such a form. It is a composite of many different forms used by a large number of agencies, and should serve as a basis for comparison. Because your agency may not have certain processes provided for here or may have others not provided for, *your form may well be quite different in content*; and because of procedural and organizational differences, you should *expect layout of the form to differ also*. The main thing is to have the content clear and complete in terms of the processes covered, and the design consistent with all of the steps taken in using the form.²

² Again see *Simplifying Procedures through Forms Control*, a management bulletin, Bureau of the Budget, June 1948.

DUPLICATING REQUISITION

4. REQUISITIONING OFFICE Bureau _____ Division or section _____ Approvals _____ Signature _____ Title _____ Signature _____ Title _____				5. FOR INFORMATION CALL Name _____ Building _____ Room No. _____ Tel. ext. _____ Night ext. _____			1. Requisition No. _____		<i>To be filled in by shop</i> Job No. _____																																										
							2. Date of requisition _____		Cost \$ _____																																										
							3. Date job required _____		Date job promised _____																																										
				WORK CONTRACTED OUT: To _____		All _____		Or what part _____		Cost \$ _____																																									
				6. DESCRIPTION OF MATERIAL																																															
				Form No. _____		Title of subject matter _____																																													
				No. pages _____		No. copies _____		Size ' x ' _____		Copy attached (Identify text, tables, figures) _____																																									
						New copy _____		Rerun _____		If rerun, give old job no. _____																																									
7. DISPOSITION OF MASTERS, STENCILS OR PLATES Destroy _____ Return _____ Hold _____ Period of retention _____						8. PROCESS WANTED																																													
9. PAPER <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th>Page No.</th> <th>Kind</th> <th>Weight</th> <th>Color</th> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </table>						Page No.	Kind	Weight	Color					10. PRINTING (If on Two Sides) Head to head _____ Head to foot _____ Head to right _____ Left _____		Retype _____		Check _____		GIVE TYPING INSTRUCTIONS IN REMARKS SUBMIT PROOF Yes _____ No _____																															
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Deliver to:	Building or address	Room	No. copies	Receipt signature	Date of receipt																																														
17. SHOP SCHEDULE AND INSTRUCTIONS <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th>OPERATION</th> <th>DATE</th> <th>OPERATION</th> <th>DATE</th> <th>REMARKS:</th> </tr> <tr> <td>Stencil cutting</td> <td> </td> <td>Assembly</td> <td> </td> <td> </td> </tr> <tr> <td>Varityping</td> <td> </td> <td>Punch</td> <td> </td> <td> </td> </tr> <tr> <td>Proving</td> <td> </td> <td>Stitch</td> <td> </td> <td> </td> </tr> <tr> <td>Negatives</td> <td> </td> <td>Cut</td> <td> </td> <td> </td> </tr> <tr> <td>Plates</td> <td> </td> <td>Fold</td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td>Mail</td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td>Inspection</td> <td> </td> <td> </td> </tr> </table>												OPERATION	DATE	OPERATION	DATE	REMARKS:	Stencil cutting		Assembly			Varityping		Punch			Proving		Stitch			Negatives		Cut			Plates		Fold					Mail					Inspection		
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An original and two or three copies of the requisition ordinarily are needed for each order. These may be distributed and used somewhat as below.

The *original* is filed in the duplicating plant (by requisition number) as a record of pending work, and transferred to the completed work file upon delivery of the job.

The *duplicate* is filed in the requisitioning office as a record of work on order, and destroyed when the quadruplicate copy is returned.

The *triplicate* accompanies work through plant processes, is used to obtain a receipt on delivery of completed work, and then filed as a record of delivery. This copy may be substituted for the origi-

nal copy in the plant's completed-work file if desired.

The *quadruplicate*, if used, is returned to the requisitioning office to show the plant job number for purposes of follow-up or inquiry. In small plants not using job numbers, *this copy may not be needed*.

For routine, repetitive classes of work, master specifications should be kept continuously on file in the duplicating shop, as previously mentioned. In normal requisitioning, then, the customer unit need only refer to the master order by number, and indicate such changing details as delivery date and quantity.

V. ARE MEN, MACHINES AND MATERIALS WELL UTILIZED?



When you size up manpower, materials, and equipment, you appraise the main elements of production. Those elements are interdependent. A deficiency in any one affects the performance of the other two. That interdependence makes analysis difficult and accuracy important.

Manpower Considerations

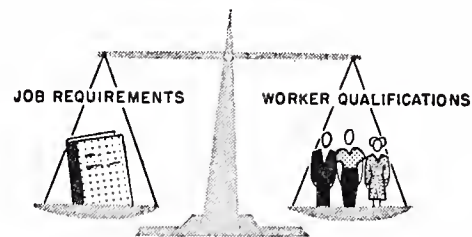
In the duplicating shop, you will probably find all the problems of personnel administration—recruitment, selection, assignment and classification motivation, training, evaluation—that you would expect to find elsewhere; and presumably your personnel office shares the burden of those problems.

Because of the craft and factory type activity in the duplicating shop, however, the personnel office may not be prepared to give as suitable service to the shop as to general agency activities. In any event, no organization unit can be relieved of certain on-the-job personnel responsibilities; and the character of duplicating work requires that some of those responsibilities be carried out more specifically and more intensively than is either necessary or possible in the more common office type activities of Government. We have found the need in agency shops for special attention to such personnel problems as: (1) identifying skill and aptitude requirements, (2) merging related skills and processes for good personnel utilization and flexibility, (3) providing necessary training, and (4) measuring and controlling performance.

Are Skill and Aptitude Requirements Known?

With only a few days of training or experience, workers assigned to some of the simpler duplicating processes often can produce a consistently fair grade

of routine repetitive work—if given ample time and granted wide tolerance for spoilage. In fact, some people in Government mistakenly assume that “fair” results are the best that can be expected from duplicating facilities. Under such an assumption, it is not surprising that essential skill, knowledge, and aptitude requirements in this work are not always recognized.



Yet, if mediocrity and waste are not to be the rule, skill requirements must be recognized not only as existing but as differing for different reproduction processes and for different steps within a process. Identification of these varying skills and aptitudes is a necessary basis for proper work grouping, classification, selection, training, and rating. Job analysis, carried out by actual observation as well as by interview, should be the basis for such identification.

The problem of recruiting and retaining competent Vari-Typer operators illustrates the results of failure to recognize necessary skills and aptitudes. The duplicating supervisor usually realizes that a worker needs “some special something” for success-

ful Vari-Typer work.³ But often, lacking proper job analysis, he “just can’t put his finger on it”—at least not convincingly enough to have the vari-typing job looked upon generally as anything more than that of “just another typist.” Classified accordingly, the job becomes either a blind alley or a training ground for non-Government shops. The job, thus, may be filled by a succession of ordinary typists who either leave promptly because the work is difficult and offers no promotion opportunity or those who stay just long enough to develop specialized vari-typing skills and then leave to take a job where those skills will be rewarded. Often the only way the supervisor can keep an operator on the job is to select one in the first place who is not capable of climbing the normal stenographic promotion ladder or of ever becoming good enough as an operator to be accepted by a private shop.

Are Related Skills Properly Merged?

As we mentioned in connection with the question of organization, you should expect closely related skills and processes to be grouped into units or sub-units for maximum personnel utilization, flexibility and effective supervision. Let us add only that, once the skills have been identified, careful charting and analysis of procedures, processes, work load, and floor lay-out often are necessary to judge existing arrangements fairly.

Is Needed Training Given?

The lack of training and good communication within the shop is often the direct cause of poor work. Often, also, it contributes to poor results indirectly by undermining morale. Such an effect comes about as other forms of supervision are in-

³ Although the Vari-Typer has a keyboard similar to that of a typewriter, the routine manipulation of keys is a much smaller part of vari-typing than it is of ordinary typewriting; and the similarity ends there. Vari-typing is done more slowly than ordinary typing, requiring perhaps a little less in the way of finger dexterity and reaction time than standard typing. Expert use of the Vari-Typer, however, requires a combination of other traits not needed to the same extent in straight typing. While some of these traits may not be necessary in a high degree, their presence in some degree is essential. These include: manual dexterity; considerable mechanical aptitude; hand-eye coordination; aptitude for spatial relations; some artistic appreciation; knowledge of copy writers’ and proofreaders’ symbols; ability to follow rather detailed instructions; and familiarity with numerous type faces and sizes, special ribbons and other special machine attachments. The Vari-Typer, moreover, is a much more expensive machine than the ordinary typewriter, and often the array of type fonts accompanying the machine represents a greater expenditure than the machine itself. This investment imposes a heavier responsibility for safe and proper equipment use than that faced by regular typists.

creased in an effort to enforce better work by “riding herd” on the workers.

You should find, in addition to induction training, a regular program of operator training in continuing effect to supplement and sharpen the shop skills available by recruitment, to keep workers informed of shop procedures and standards, and to take advantage of new duplicating techniques as they develop. The form of such training may vary according to the size and complexity of the shop, but by formal or informal methods it should be systematically carried out. Such training is especially necessary as a basis for the flexibility needed to meet fluctuating work loads. Many agencies have found equipment and supply manufacturers to be helpful by supplying technical training materials and sending representatives to give instructions in the use of their products.

The training problem of the duplicating shop is not limited to its own workers. There must be some way to be sure that all personnel throughout the agency who prepare stencils, plates, or other masters are trained to do that work properly. The shop cannot run quality work from poorly prepared masters; and often the speed of production, as well as the quality, is affected by the condition of the master. Similarly, those persons responsible for planning work to be reproduced, and for preparing requisitions, must be kept informed of shop requirements, facilities, and procedures. This particular training can be accomplished partly by means of clearly written agency-wide or bureau instructions and by such supplemental aids as the selection charts shown in this bulletin; but occasional training meetings on the subject, backed up by a good deal of personal missionary work on the part of the duplicating supervisor or the administrative-service chief, are usually needed also.

Is Performance Measured?

You will find that most work in the duplicating shop can be quite objectively measured, not only for the impersonal purposes of production, quality and cost control (to be reviewed in remaining chapters), but for checking the progress of individual workers. Such measurement gives a tangible basis for making employee service ratings (efficiency ratings) and, even more important, for judging the day-to-day need of individual workers for training and other supervisory guidance.

The means usually provided for measuring individual productivity is the daily reporting of time and

MONTHLY RECORD OF DAILY PRODUCTION

Month Unit					Machine Number or Operator's Name				
Type of Operation or Machine					Unit of Output				
DATE	NO. OF JOBS	UNITS PRODUCED	REGULAR HOURS	OVERTIME HOURS	DATE	NO. OF JOBS	UNITS PRODUCED	REGULAR HOURS	OVERTIME HOURS
1					16				
2					17				
3					18				
4									
15					30				
					31				
TOTAL									

ing which specific units of equipment are suitable and which may be excessive in a given situation requires (1) an analysis of work requisitioned over a period of time, (2) a knowledge of equipment on the market (including new developments), and (3) an understanding of the regulations issued by the Congressional Joint Committee on Printing, relative to the definition of printing, classification of printing plants, and authorization of equipment.⁴

By analyzing completed requisitions you can determine the frequency of demand for various quantities and various page sizes; for color work; for close registration; for line or half-tone illustrations; for reprint work; for folding, perforating, or scoring; for enlargement or reduction of image; and for other specified reproduction and bindery operations. Also in reviewing old requisitions you can see how often work has had to be sent out to other

shops because of limitations in your own shop. You should find out what processes were involved and how much work had to be sent out for each process.

In addition to the analysis of demand (taken from the requisitions), a report of actual versus potential production can be drawn up from time to time to show how fully the existing equipment is being utilized. The figures for such a report can be drawn at any time from the regular daily operator tallies (fig. 3). While the process schedule sheets or the regular monthly production summary (to be discussed in the next chapter) will show total output as against the potential for each process, this utilization report should show output against potential for each individual machine performing the process. Ordinarily this report is needed only if the difference between output and capacity for any process is shown by the schedule sheets or the production report to be excessive.

Here is one convenient way to draw up such a special machine utilization report:

⁴ *Regulations of the Joint Committee on Printing, Congress of the United States, relative to Government Printing and Binding, July 1, 1948.*

Date _____		Period covered _____		
Type of Machine	No.	Capacity (Impressions)	Actual Production (Impressions)	Utilization (%)
Hectograph	3	99,999	77,777	78%
Stencil Dup.	7	299,999	211,111	70%
Offset	6	200,000	200,000	100%

FIGURE 5

Analysis of requisitions (for demand by process) and of output against capacity (for existing equipment) should, when considered in the light of available and permissible equipment, tell you which makes and models of machines you should have and which labor-saving attachments and accessories (such as quick-change clamps, slip-sheet devices, automatic feeders and stackers, adapters, extra ink drums, and so on) may be justified. The analysis should show up excesses as well as deficiencies; and, once identified, any surplus equipment should be promptly declared and disposed of through appropriate channels.

Is Equipment Placed Right?

Just as the selection of equipment has a direct bearing on economy of operation, so does the lay-out of the equipment within the shop. The preparation of a flow chart, tracing typical jobs from receipt of requisition, through processing, to delivery, should show up erratic cross movements and backtracking that could be eliminated by better shop lay-out.⁵

What About Maintenance?

Equipment life is extended, productivity and quality are improved and dead losses from down time are reduced by proper upkeep. While the cost

of unnecessary calls by commercial service mechanics is to be avoided by having operators or supervisors fully trained to make proper machine adjustments, the cost of operating out-of-condition equipment is equally to be avoided. In this connection, the extent to which the agency should provide its own repair service depends upon the size of the shop and the accessibility and cost of adequate service from outside. In any event, care should be taken to avoid paying for maintenance services covered by the original machine purchase contract. You should check maintenance and repair records for the frequency and cost of past repairs as a basis for investigating alternative sources of service. In addition to a record of break-down time for each machine, and of personnel time spent in repair work, vouchers should show costs for any outside repair service purchases.

Supply Considerations

Proper material and supply management not only cuts waste but adds positively to the rate and quality of reproduction. Stock selection, standardization, flow, and issuance control are key points to check.

Are Materials Suited to the Work?

You can't expect a finished product consistent with the cost of men and machines if you have an inadequate selection of working materials and sup-

⁵ See the management bulletin, *Process Charting*, Bureau of the Budget, November 1945.

plies. On the other hand, undue *variety* reduces productivity, increases purchasing costs, and complicates stock-maintenance procedures, while undue *quantity* adds to shelf loss and storage cost.

Consistent with Bureau of Federal Supply regulations, your materials and supplies should be selected to match the equipment in use. Unless positive experience points to a better choice, the machine manufacturer's recommendations usually should be followed. Frequently the materials and supplies so recommended have physical or chemical properties especially suited to the characteristics of the machine. Certainly, however, for any supplies used in volume, you will want assurance that the suitability of the other brands has been fully checked.

Are Materials Properly Standardized?

Allowing for necessary selectivity, consider the degree of standardization reached. Confining page and card sizes to standard multiples of purchased mill stock is a simple way to save paper and paper-cutting costs. Keeping the weights, grades, and colors of paper to a reasonable number of standard selections facilitates the writing of specifications by customer units, simplifies procurement and storage, allows for volume discounts in purchasing, reduces machine set-up and adjustment, and contributes to uniformity and quality in finished work. The standardization of inks, cleaners, plate chemicals, and other materials and supplies makes for similar economies.

Examination of the stockroom and stock records often reveals excessive inventories, when considered in the light of frequency and quantity of use. Although no generally applicable turn-over period has been established, replenishment schedules should vary in proper relationship to (1) necessary lead time in ordering, (2) amount used, and (3) storage space available. A 3-month supply of one product from a ready source may be too much if storage space is at a premium. Of another product, or under other conditions, a 3-month level might not be enough.

The range of item selection found during inspection should show the effect of any efforts to standardize. Further, the presence of certain supplies (such as an unusual array of colored inks) or the absence of certain others may point not only to inadequate choice of materials but to attempts to produce types of work for which the plant is not economically suited.

Another kind of standardization found effective is the fixed specification of process, materials, and format for recurring kinds of work. This practice permits an orderly scheduling of material requirements for such work and makes it possible to dispatch proper materials to the work stations without the delay of having to decide material characteristics each time a requisition is received. In addition, the customer units are more likely to be consistently satisfied with the quality of finished work by having had a voice in setting up the standards.

The use of preprinted reproducible masters or die-cut stencils is one means of standardizing format, assuring uniform quality, and at the same time reducing supply requirements for some forms and letterheads.

Take, for example, a form which is used in large numbers and which often has to have many carbon copies made when it is filled out or often has to be reproduced after it is filled out. A supply of such a form can be produced originally in hectograph ink instead of ordinary printers' ink. Then, when filled in (with hectograph pencil, hectograph ink, or hectograph typewriter ribbon), both the form and the information entered on it can be reproduced together, simply by using the filled-in form as a hectograph original (or master).

Similarly, the design of the form can be impressed on duplicator stencils by means of a printing press. To reproduce a completed form, then, only the fill-in information needs to be typed or written on the stencil.

If the number of copies made of any single filled-in form is seldom great enough to justify hectograph or stencil reproduction, the form can be preprinted on translucent paper and when filled in, reproduced as needed by dry-process contact photo copy (as by Ozalid)—a plan that is especially adaptable because the original form can be used just as can any ordinary one and filled in with dark ink, pencil, or typewriter ribbon. The user does not have to be concerned about whether copies will be needed or not. Yet if they are needed, they can be made quickly, clearly and legibly. If a greater number of copies should sometimes be necessary than can be economically made by photo-copy methods, the same original is suitable for offset reproduction. (See center-piece, Guide to Reproduction Methods.)

Do Materials Flow Efficiently to Work Stations?

We have referred already to the desirability of a

TEXT MATTER	CHARTS, LINE DRAWINGS	BLANK FORMS	FORMS WITH FILL-INS	REPRINTS	ILLUSTRATIONS	COLORED COPY
<p>Typewritten - with no illustrations or cross rulings - black and white only. BULLETINS, DIRECTIVES, REPORTS, CIRCULAR LETTERS (Black ink signatures) LISTS, SIMPLE TABLES OF FIGURES.</p> <p>Typewrite, making as many carbon copies as needed - see chart in general section for guide.</p>	<p>Tabular matter, graphs, ink drawings of black and white nature which include slip-a-tone or Ben Day Tints and hand or mechanized lettering. CHARTS, MAPS, GRAPHS, COMPLICATED TABLES OF FIGURES, ETC., including line, solids or shading media - see Processing Section.</p>	<p>All types of Office and Field forms. (All forms must be submitted through the Forms Control Section of each Bureau.) NAVY FORMS, INTER-OFFICE AND FIELD FORMS, ROUTE SLIPS, ETC.</p> <p>For up to 10 copies TYPEWRITE with carbon copies if practicable. If too complicated for typewriting</p>	<p>(For multiple copies after information has been added to blank forms.) (All forms must be submitted through each Bureau Control Section of each Bureau.) I.B.M. TABULATIONS, FIELD REPORTS, INITIAL INVENTORIES, INITIAL OUTFITTING LISTS, ETC.</p> <p>If two or three carbons, use loose forms and carbon paper; if four to ten copies consult your Forms Control Section, for pre-soliated sets or continuous strip forms.</p> <p>If more than ten to fourteen and more than about one hundred copies are needed.</p>	<p>Line or text only, no half-tones or continuous tones. MATERIAL WHICH HAS ALREADY BEEN PRINTED OR REPRODUCED OF WHICH ADDITIONAL COPIES ARE WANTED. MAGAZINES OR BOOKS, PAMPHLETS, ETC., OR SIMILAR MATERIAL.</p>	<p>(Continuous tone including all mixed copy containing continuous tone material regardless of the rest of the copy.) PHOTOGRAPHS, DRAWINGS, HALF-TONES OR ILLUSTRATIONS COMPOSED OF VARYING ONES OF GREY OR TONES OF COLOR.</p> <p>(Not including shading media used on charts or graphs)</p>	<p>(All colored or black with color) TYPING OR DRAWING, WITH OR ON OZALID, VAN DYKES, BLUEPRINTS, HECTOGRAPHS. BLUE INK SIGNATURES ON LETTERS.</p>
<p>1 to 10 Copies</p>	<p>USE PHOTOSTAT</p> <p>If copy is on opaque paper, or</p>	<p>USE OZALID</p> <p>If form is complicated, processing will prepare and make transparency. Consult your Forms Control Section or</p>	<p>USE HECTOGRAPH</p> <p>a) with forms printed in black ink for fill-in with hecta carbon for master, or</p> <p>b) with pre-printed masters in sets with hecta carbon.</p>	<p>USE PHOTOSTAT</p> <p>If only a representation of tonal gradations is required.</p>	<p>USE PHOTOSTAT</p> <p>If absolute fidelity of tonal gradations is required, or</p>	<p>USE PHOTOSTAT</p> <p>(Does not reproduce in color)</p>
<p>11 to 50 Copies</p>	<p>USE OZALID</p> <p>(If copy is on opaque paper Processing will make transparency)</p>	<p>USE HECTOGRAPH</p> <p>If form is simple in design and master can be prepared on typewriter, or</p>	<p>USE MIMEOGRAPH</p> <p>a) with forms printed in black on mimeograph paper, or</p> <p>b) with die-impressed mimeograph stencils for reproduction on blank paper.</p>	<p>USE OZALID</p>	<p>USE OZALID</p>	<p>USE OZALID</p> <p>(Does not reproduce in color)</p>
<p>26 to 150 Copies</p>	<p>USE HECTOGRAPH</p>	<p>USE MIMEOGRAPH</p> <p>If form is simple in design and master can be prepared on typewriter.</p>	<p>USE OFFSET</p> <p>a) with masters pre-printed on paper plates for fill in on tabulating machine or typewriter.</p>	<p>USE OFFSET</p>	<p>USE OFFSET</p>	<p>USE OFFSET</p>
<p>51 to 1000 Copies</p>	<p>USE OFFSET</p>	<p>USE OFFSET</p> <p>If form is more complicated</p>	<p>USE OFFSET</p> <p>b) with master prepared on ordinary blank forms for plate-making to offset</p>	<p>USE OFFSET</p>	<p>USE OFFSET</p>	<p>USE OFFSET</p>
<p>151 to 3500 Copies</p>	<p>USE OFFSET</p>	<p>USE OFFSET</p>	<p>USE OFFSET</p>	<p>USE OFFSET</p>	<p>USE OFFSET</p>	<p>USE OFFSET</p>
<p>More than 3500 Copies</p>	<p>USE OFFSET</p> <p>Planning copy for suitable reduction to save paper. See guide on page 46.</p>	<p>USE OFFSET</p>	<p>USE OFFSET</p>	<p>USE OFFSET</p>	<p>USE OFFSET</p>	<p>USE OFFSET</p>
<p>Over 75000 Units</p>	<p>IF THE NUMBER OF COPIES MULTIPLIED BY THE NUMBER OF UNITS EQUALS MORE THAN 75,000, CONSULT PRINTING SECTION IN YOUR OWN BUREAU OR OFFICE OR IN THE PUBLICATIONS DIVISION, ADMINISTRATIVE OFFICE, FOR ADVICE.</p>	<p>IF THE NUMBER OF COPIES MULTIPLIED BY THE NUMBER OF UNITS EQUALS MORE THAN 75,000, CONSULT PRINTING SECTION IN YOUR OWN BUREAU OR OFFICE OR IN THE PUBLICATIONS DIVISION, ADMINISTRATIVE OFFICE, FOR ADVICE.</p>	<p>IF THE NUMBER OF COPIES MULTIPLIED BY THE NUMBER OF UNITS EQUALS MORE THAN 75,000, CONSULT PRINTING SECTION IN YOUR OWN BUREAU OR OFFICE OR IN THE PUBLICATIONS DIVISION, ADMINISTRATIVE OFFICE, FOR ADVICE.</p>	<p>IF THE NUMBER OF COPIES MULTIPLIED BY THE NUMBER OF UNITS EQUALS MORE THAN 75,000, CONSULT PRINTING SECTION IN YOUR OWN BUREAU OR OFFICE OR IN THE PUBLICATIONS DIVISION, ADMINISTRATIVE OFFICE, FOR ADVICE.</p>	<p>IF THE NUMBER OF COPIES MULTIPLIED BY THE NUMBER OF UNITS EQUALS MORE THAN 75,000, CONSULT PRINTING SECTION IN YOUR OWN BUREAU OR OFFICE OR IN THE PUBLICATIONS DIVISION, ADMINISTRATIVE OFFICE, FOR ADVICE.</p>	<p>IF THE NUMBER OF COPIES MULTIPLIED BY THE NUMBER OF UNITS EQUALS MORE THAN 75,000, CONSULT PRINTING SECTION IN YOUR OWN BUREAU OR OFFICE OR IN THE PUBLICATIONS DIVISION, ADMINISTRATIVE OFFICE, FOR ADVICE.</p>

The use of this chart permits choice of several methods depending on the nature of the job.

Based on Equipment and Supplies Common

A

B

PROCESSES		PHOTOCOPY		SPIRIT HECTOGRAPH
FEATURES and LIMITATIONS	(1) DRY CONTACT PROCESS (Ozalid, etc.)	WET PROCESS		(Ditto, etc.)
	(2) CONTACT	(3) INDIRECT (Photostat, etc.)		
1. NUMBER OF COPIES ORDINARILY FEASIBLE (Including any reruns)	1 to 25	1 to 15		11 to 150 ²
2. KINDS OF COPY FEASIBLE (Types of work suited to the process)	Any text or graphics			
a. TEXT and tables	YES	YES	YES	YES
b. Simple charts and line sketches	YES	YES	YES	POSSIBLE
c. Complex drawings	YES	YES	YES	NO
d. Halftones (photographs)	NO	YES (Mediocre)	YES	NO
e. Reprints (Secondary use or recopy of printed or published matter)	POSSIBLE	YES	YES	NO
f. Forms	CLEARANCE RUNS ONLY			Forms of SIMPLE DESIGN or for INTERIOR
g. Forms with fill-in	POSSIBLE	YES	YES	NO
h. Preprinted reproducible master forms with fill-in	Fill-in on pre-printed translucency	NO	NO	YES on preprinted matter
3. COPY REQUIREMENTS (What has to be submitted to shop with requisition)	Any clean legible copy Should be on one side only of translucent material	Any Copy		Typed hectograph master sheets (from carbon normally prepared by ordering job)
4. SIZE LIMITATIONS	Any length and up to 54" wide	Consult if over 18" x 24"	(Enlargement or reduction feasible) Any size up to 29" x 37 3/4" Up to 18" x 24"	Up to 14" x 20"
a. Original copy	Same size as original			
b. Reproduced page				
5. COLOR LIMITATIONS (two or more colors of ink, or any one other than standard, only on special justification)	Black on white is standard; other colors possible	Only black on white	Only black on white or reverse	Purple on white is standard Other colors seldom feasible
6. FEASIBILITY OF TWO-SIDE PRINTS	NO	NO	NO	(With some equipment)
7. QUALITY OF RESULTS ⁴ (assuming average skill and materials) by printing standards	Poor to good	Good to very good		Fair to good
a. Legibility	Very good	Poor		Good
8. APPROXIMATE MACHINE PROCESSING SPEED ⁵	30 seconds per exposure	15 minutes		75 copies per minute
9. APPROXIMATE COST (Not counting copy preparation or bindery work)	2 cents a copy (Up to 8 1/2" x 14")	10 cents a copy (Up to 8 1/2" x 14")		1 Side 25¢ — First 100 — 5¢ 3¢ — Each add. 10 — 5¢ (Not counting masters at 3¢ a set)

¹ Other processes used in the agencies include gelatin hectographing, automatic typewriting, office-rotary printing (as by Multigraph) and automatic addressing (as by Addressograph). See appendix. Each plant or agency should develop its own chart based on the makes and models of equipment used and on its own production and cost experience.

² This column (E) is for general comparison only. It refers to all

of the traditional printing processes as a group, although actually there are important differences among them. (See appendix.) When quantity or quality requirements cannot be met economically by duplicating facilities, traditional printing is the alternative; but a choice must be made among the printing processes available. Although there are not as many of those as of duplicating processes, there are a great many more variables to be considered within each

DUCTION METHODS

CENTERPIECE EXHIBIT B.

Used in Federal Agency Duplicating Shops¹

C		D		E
STENCIL PROCESS		OFFSET PROCESS		RELIEF, INTAGLIO, AND LARGE-SCALE OFFSET ²
(Mimeograph, etc.)		(Multilith, etc.)		(Letterpress, gravure, lithography) Note: Always consult printing officer or GPO liaison in advance
		(1) DIRECT-IMAGE	(2) PHOTOGRAPHIC-IMAGE	
	11 to 5,000 ³	26 to 5,000 ³	500 to 25,000 ³ (26 to 25,000 for reprint work)	OPEN (Consult)
Text, tables and simple charts		Any text or graphics (especially economical for reprinting)		Any text, and any graphics, if quantity justifies
YES	YES	YES	YES	YES
POSSIBLE	YES	YES	YES	YES
NO	POSSIBLE	YES	YES	YES
NO	NO	YES	YES	YES
NO	NO	YES	YES	YES
for TRIAL or CLEARANCE . . . L or TENTATIVE USE	FORMS OF SIMPLE DESIGN	YES	YES	YES
NO	NO	YES	YES	SELDOM FEASIBLE
YES or die-impressed stencil	YES on preprinted plate	NO	NO	NO
Typed stencils normally supplied by office ordering job. Special typing, lettering, or drawing on stencils can be done in shop if justified; submit ms. marked to specify type and format	Typed direct-image plates (paper, plastic or metal) normally supplied by office ordering job. Special typing, lettering or drawing on plates can be done in shop if justified; submit ms. marked to specify type and format	Any legible copy (type-written, drawn or clipped and pasted, ready to photograph). If special typing, lettering or drawing is needed submit ms. or dummy marked to specify type and format		Manuscript and/or dummy marked to specify type and format in detail
		(Enlargement or reduction feasible)		
Up to 8½" x 14"	Up to 11½" x 14"	Up to 30" x 40"		
Same size as original		Up to 17" x 21"		
Black on white is standard				
Colored ink rarely feasible		Colored inks available if properly justified		Colored paper if needed Choice of ink in single color; two or more colors limited
YES (at reduced quality)	YES	YES	YES	YES
Fair to very good Pencil fair; ink poor	Fair to excellent Good to excellent	Good to excellent Good to excellent	Good to excellent Good to excellent	Good to excellent Fair to excellent
100 per minute	100 per minute	6,000 per hour		Highly variable
1 Side 35¢ — First 100 — 45¢ 15¢—Each add. 100—20¢ (Not counting stencils at 3 cents to 12 cents each)	1 Side \$0.80 — First 100 — \$1.30 .20—Each add. 100—.28 (Not counting direct-image plates at 3¢ to 20¢ each)	2 Sides \$2.80 — First 100 — \$4.15 .20—Each add. 100—.28 (Including negatives and plates)		Price on application only

process. Consult your publications-control or printing officer.

² Certain masters, stencils, or plates, under ideal conditions, can produce higher quantities economically.



































































³ Higher quality may be attained under ideal conditions. In fact, under "laboratory" or "studio" conditions, quite artistic results are to be had, with varying degrees of difficulty, by any of these processes. All data on this chart, however, are estimated on the basis of ordinary operating conditions in Government shops, with

very limited control exercised by the shops over the preparation of original copy, masters, or stencils for routine classes of work.

⁴ Higher rates of production are sometimes possible. On the other hand, the rates given here do not indicate the time required to get work back from the shop. Jobs cannot always be scheduled for immediate production; and, once scheduled, varying amounts of time are required for make-ready and for collating and finishing operations.

Centerpiece Exhibit C

DUPLICATING GUIDE

	NO. OF COPIES REQUIRED QUANTITY CLASS		10 TO 100				100 TO 2,500				2,500 TO 5,000				5,000 TO 10,000															
	A		B				C				D				E															
REPRO- DUCTION QUALITIES OF STENCILS OR MASTERS			  				  				REPRO- DUCTION QUALITIES OF STENCILS OR MASTERS				  	REPRO- DUCTION QUALITIES OF STENCILS OR MASTERS				  										
TYPOGRAPHY (LEGIBILITY, STYLE, AR- RANGEMENT & APPEARANCE)			  				  				TYPOGRAPHY (LEGIBILITY, STYLE, AR- RANGEMENT & APPEARANCE)				  	TYPOGRAPHY (LEGIBILITY, STYLE, AR- RANGEMENT & APPEARANCE)				  										
EXPANSION OR REDUCTION OF COPY			  				  				EXPANSION OR REDUCTION OF COPY				  	EXPANSION OR REDUCTION OF COPY				  										
WRITING QUALITY OF PAPER USED			  				  				WRITING QUALITY OF PAPER USED				  	WRITING QUALITY OF PAPER USED				  										
SPEED AND ECONOMY			  				  				SPEED AND ECONOMY				  	SPEED AND ECONOMY				  										
		PROTOSTAT	DITTO				MIMEOGRAPH				STEROLITH				PRINTING				STEROLITH				MULTILITH				PRINTING			

LEGEND					
100%	100%	50%	25%	10%	NOT SUIT- ABLE
EFFECTIVENESS IN THE GIVEN QUANTITY AND QUALITY CLASS					

BASIC DEPARTMENTAL DUPLICATING STANDARD

JOB OVER 80,000 IMPRESSIONS MUST BE
SENT TO THE GPO FOR PROCESSING.

INSTRUCTIONS FOR USE OF THE DUPLICATING GUIDE

1. Decide on the minimum number of copies which will serve your purpose.
2. Locate that number on the quantity scale indicated by the arrow. The columns below each quantity class contain the information concerning certain quality factors which affect the choice of process.
3. Study the various quality factors and decide which ones apply and the relative importance of each to the job at hand.
4. Pick out the most acceptable process and prepare the requisition accordingly.

Example:

- a. Supervisor states he wishes 500 copies of a report containing 10 pages of textual material in a hurry.
- b. Clerk recognizes that the job does not require printing according to the standards set forth in the instructions of the Chief Clerk No. 41.
- c. Referring to the "Duplicating Guide" the clerk determines that the job falls in the quantity class "C", 100 to 2,500 copies.
- d. By reference to the columns below, the clerk determines that the mimeograph process will give the most rapid service. The clerk analyzes the job and determines that the remaining quality factors are unimportant or do not apply.
- e. Clerk prepares stencils and requisition specifying the mimeograph process.

straight-line flow of work. Location of the stockroom has an important bearing on this. If your stockroom cannot serve directly as a supply feeder, synchronized to the work flow, the provision of daily stocks at work stations may be an effective substitute. In some cases this practice, carried out on the basis of potential production, has permitted a rather tight control of overruns and spoilage.

Is Waste Controlled?

Materials used represent an important part of the unit cost of work produced. (See ch. VII.) If costs are to be kept in line, waste must be carefully controlled.

If supply requisitions are not designed to identify the processes for which specific supply items are issued, or if supply requisitions are not used by the shop, tallies should be kept of the supplies issued according to the process in which they are used. For example, a pound of ink issued to an offset operator

can be chalked up on an ink tally under the heading of "offset" or else on an offset supply tally under the heading of "ink."

Because paper is the main supply item in duplicating, a continuous control of that product is especially needed in all plants. Whether based on supply requisitions or tallies, such control makes possible a special paper-utilization report at desirable intervals.

The report, when called for, should show the number of unprinted sheets consumed in each process as compared with the printed sheets delivered by each process. The difference would reflect overruns, spoilage, and other waste; and an abnormal waste figure should be cause for supervisory follow-up to determine and correct the cause (perhaps including the daily checking of work-station waste cans for a trial period).

Here is one way to arrange such a paper utilization report:

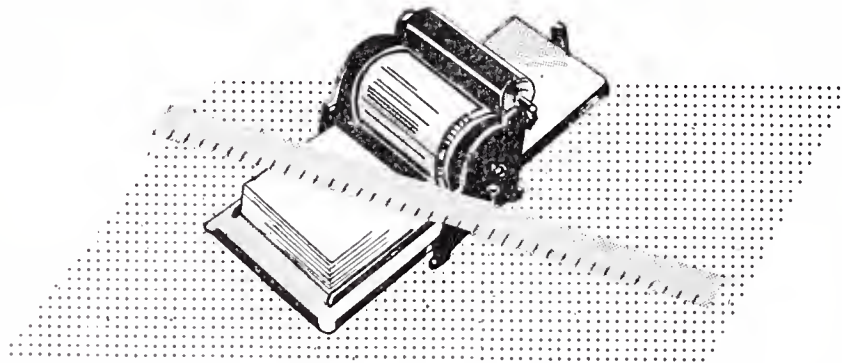
Date _____		Period covered _____	
Type & Size of Paper (by process)	No. Sheets Issued (in thousands)	No. Duplicated Sheets Delivered (in thousands)	Loss (in %)
Mimeo			
8"x10½"	999	919	8%
8"x12½"	111	103	7.5%
Hectograph			
8"x10½"	749	674	10%
8"x12½"	99	96	
Offset			

FIGURE 6

Unlike the normal inventory and cost-accounting records, the special paper-utilization report need not show all the paper used in the shop during the period covered. Ordinarily, it is enough, in this special

report, to cover only the regular types and sizes that are procured ready cut and used in large quantities for repetitive classes of work.

VI. IS PRODUCTION UNDER CONTROL?



As we have said, manpower, equipment, and materials are interdependent. Their combination accounts for production. So, in addition to keeping his workers, his machines, and his materials each under control as such, the plant supervisor has the still tougher job of keeping the interaction of all three in tune for efficient production. In a shop of any size this is not a simple job. It is a job which is complicated not only by the multiple relationships existing at any given time among the production elements named, but also by the changing nature of the elements themselves. It is a job that cannot be done without certain control tools.

Any complete approach to production control includes (1) *reducing fluctuations* in work load, (2) *balancing* work flow in terms of work stations and workers, (3) *scheduling* operations and materials, and (4) *dispatching* work according to the schedule. You should expect to find evidence of all of these in a well-run shop. But, in approaching the appraisal of duplicating activity from a point of view broader than production control alone, we have already, under other topics, touched upon some of those aspects. For example, in discussing work planning, screening, and coordinating we touched upon problems of leveling out and otherwise improving the intake of duplicating work load. In discussing organization and manpower we mentioned some of the problems of balancing and dispatching; and at several points we have touched upon problems of scheduling. Essentially, it is those aspects of production control which are not a matter of manpower alone, machines alone, or materials alone—but the active interrelationship of all three—that we have saved until now to consider. These we will take up under the headings of—

- (1) Work scheduling,
- (2) Dispatching (or job control),
- (3) Production standards and reporting,
and
- (4) Quality control

You would not expect these internal operating controls to be identical in every well-operated plant. The controls in small shops generally can be less formal and less complex than those needed in large shops. Controls in single-process shops can be simpler than those needed in multiple-process shops. But whether as a single, simple procedure or as several related procedures, formal or informal, and by whatever name, the objective remains the same—to keep management on top of a changing situation.

Work Scheduling

The main purposes of work scheduling are two: (1) to help forecast ability to meet production demands, and (2) to help stabilize and coordinate work load for maximum use of workers and equipment.

Because finished work cannot emerge any faster than the slowest operation required, the facilities for performing the several operations have to be balanced out in terms of potential production so as to avoid bottlenecks at individual work stations. Careful scheduling heads off unbalanced conditions and provides information necessary to cope with them.

Scheduling Procedure

The essentials of a simple scheduling plan, found successful by agency surveys, are as follows:

Depending on how far ahead the shop needs to

plan, a series of schedule sheets, like the one suggested in figure 7, may be kept in the supervisor's office for each process that is regularly used—a different sheet for each process for each day within the period under schedule. If several workers perform an identical process, a single sheet usually will serve the group for any one day. All machines of the same class (such as all mimeograph machines) *usually* are considered to be performing an identical operation and are scheduled jointly on the same sheet, making it possible to combine work-scheduling and work-station-assignment records in small shops if desired (see *Dispatching*).

Form 000
June 1948

FIGURE 7

DAILY PROCESS SCHEDULE				
OPERATION				DATE
OPERATORS AVAILABLE				MAN-HOURS AVAILABLE
JOB OR REQUISITION NO. (1)	UNITS OF WORK (or man-hours) COMMITTED (2)	PRODUCTION CAPACITY POTENTIAL UNITS OF WORK (or man-hours)		REMARKS (For any given job, indicate dates of earlier work done or of further work to be done) (5)
		Regular (3)	Reserve (4)	
		Total	Total	
1		Bal.	Bal.	
2		Bal.	Bal.	
3		Bal.	Bal.	
23		Bal.	Bal.	
24		Bal.	Bal.	
25		Bal.	Bal.	

Above the first line of columns 3 and 4 is placed the estimated potential production for the designated day and operation, based upon previous experience. The estimate in column 3 is for regular production while that in column 4 is to cover emergency orders. As requisitions are received, work-unit requirements are estimated for each operation involved; and these estimates are posted to the appropriate schedule sheets, column 2, to show the number of work units thus committed. As each estimate is entered in column 2, it is deducted from the potential (in the line above of column 3 or 4) and a new remainder (potential) entered in column

3 or 4. When the total work units posted to a day's schedule sheet for any process equal the total potential, any further requisitions requiring that process must be scheduled for another day, or lower-priority work in the schedule must be postponed. As the close of a day approaches, any remaining reserve for that day (column 4) is made available for stand-by or run-of-the-mill work. Those operations that cannot be scheduled in units of output may be scheduled in man-hours.

Work allocated on the schedule sheets but not actually completed according to schedule must be carried over to the sheet for a later day and deducted

from that day's estimated potential. Periodic review of carry-over work reveals points of weakness requiring corrective action.

You should find that regular recurring jobs are scheduled and facilities reserved well in advance, and that long-run one-time or intermittent jobs are brought to the attention of the plant in time to permit the orderly scheduling of short-run work. To the extent necessary, large orders for duplicated materials to be used over a long period of time should be broken up and run intermittently to fill in gaps in the schedule and even out the work load.

Source of Schedule Potentials

In determining the production potentials necessary for scheduling, use should be made of the production standards which we will come to a little later.

In estimating potentials for processes not used full-time, however, something more than a standard production rate is needed; a forecast must be made of the man-time to be available.

Records of past production will show fluctuations in the demand for each duplicating process on different days of the month during different seasons. Allowing for known and expected changes in circumstances, the total man-time to be available can be apportioned among the processes to be scheduled, and potentials adjusted accordingly.

In using such adjusted potentials, care is needed to be sure that no machine in part-time use is considered necessary solely because it is operated up to the scheduled capacity. As we have suggested already, a further check of equipment utilization should be made in terms of total machine capacity rather than the scheduled potential.

While it is desirable to have all of the regular production in the shop under schedule, it is seldom feasible to attempt precise scheduling of processes which (however necessary they may be) do not claim any substantial amount of man-time or do not represent a high investment in equipment. For example, a small photo-copy machine may be needed for high-priority rush work. It may be cheaper to maintain the machine than to buy the needed service outside; yet the machine may be in actual use only a small part of the total working day—operated by the supervisor, a clerk, or any worker in the shop who can be spared temporarily from his regular duties. Scheduling such a process might easily be a waste of time. On the other hand an expensive piece of

equipment—let's say an offset machine—is rarely justified if not in use most of the time. If such a machine is justified, scheduling its operation is usually justified also.

Dispatching (job control)

You cannot expect very good service if job requisitions are placed in an intake hopper and given no further attention by the supervisor until the jobs are ready for delivery. Shop supervisors need to know the status of each job in process in order to follow up on the work and to advise customers on the progress of their orders. Dispatching—or what is often known in the shops as job control—provides that knowledge.

As a basis for effective dispatching, the experience of many agencies has shown the importance of maintaining (1) a complete file of requisitions (including original copy specimens), (2) a chronological register or log of work received, and (3) work station assignment records (if the shop is large).

Requisition Files

The requisition files are usually set up so that requisitions for work in process are separated from those for completed work. The first file serves to keep requisitions readily available for work scheduling and other supervisory purposes pending delivery of work. The second keeps requisitions available for any necessary post-check of specifications, including special analyses of work produced over a period of time, such as you might want to make in checking on the adequacy of process selection. The arrangement of the files varies in different agencies. In some instances a simple requisition number sequence is followed. In others filing is done by requisition number within major customer groupings. One year is ordinarily as long as completed requisitions need to be saved.

If yours is a large plant you might expect to find a separate series of job numbers assigned consecutively to requisitions as they are received. The requisitions then may be filed by job number in the uncompleted work file and later by requisition number in the completed work file. Cross-reference from requisition number to job number, necessary to trace inquiries when only one or the other number is known, is provided by the register of work received, which we will describe below. Under this plan a copy of each requisition, bearing the job number assigned and the estimated date of com-

pletion, is returned to the customer as soon as the job has been scheduled.

The Register of Work Received

A chronological record of work requests is almost always considered necessary. While the nature of this record differs among agencies we have incorporated the useful features of many forms into the composite illustrated in figure 8.

Each requisition is logged as it is received in the plant supervisor's office, postings being made to the register of work received to show the date and time received, the type of job (new, revised, or rerun), the number of different originals and the number of copies of each original required, the total number of impressions, and the date of delivery.

This log should serve as a cross-reference between job and requisition numbers. In addition, the information summarized on it reduces the number of references that have to be made to the requisition file to check on any specific job. The log gives a quick over-all picture of lapsed time between receipt of orders and delivery of work, the general trend of work load by process, the frequency of short-run jobs and so on. It is helpful in the preparation of monthly production reports. If yours is a small plant, however, you may find that copies of requisitions can be made to serve all the purposes of the register.

THE WORK-STATION ASSIGNMENT RECORD is usually an informal notation of the date, time, and job or requisition number, made by the operator or his supervisor as each job moves to a new processing point. The main purpose of this record is to provide a quick way of locating specific jobs in process throughout the plant. The central log (or register) leads to the appropriate processing section (or unit); and the work station assignment record, kept within the section, leads directly to the right work station, without sorting and searching. It serves also to keep the operator informed of the work ahead of him and the order in which it should be produced. Such a record should be necessary, however, only in large plants or in agencies having scattered equipment under centralized supervision.

Some very large shops, on the other hand, find it desirable to maintain a more elaborate work assignment record in the form of a central control board on which job tickets are placed schematically as work moves from one point to another.

Production Standards

Are men and machines turning out as much work as they should? Rule-of-thumb estimates of productive capacity result only in rough approximations of total efficiency. Precise standards of production are the only satisfactory basis on which your shop can forecast its ability to meet demands, schedule its work realistically, and check its progress toward production goals. Abnormal deviations from standard output should be the signal to hunt down the causes and get corrective action started.

Developing Production Standards

While the chief usefulness of production standards is in setting up fixed reference points for estimating potentials and checking machine and operator performance against the potentials, the comparison of standards for similar operations in different plants offers a rough index of relative efficiency—one factor in reconsidering now and then the kind and amount of service to be maintained.

You should have standards for every important operation in your plant. To be valid the standards must be based upon actual production experience in that shop. While rated capacities are available for each different make and model of reproduction machine, you have to modify such rates for various working conditions (plant humidity, for example), and for quality of masters and materials used. You need to give full consideration to the time required for every step the machine operator must perform, such as getting supplies, loading paper, inking, applying masters, adjusting the machine, unloading the stacker, and removing masters; and you must make allowances for fatigue and other delay factors. It is not enough to adjust manufacture-rated machine speeds arbitrarily for such conditions; time tests should be made, verified, and refined until all steps entering into the various classes of work processed on each type of machine can be accurately rated, and the rates "leveled" to the skill of the average operator. Likewise, standards for regularly recurring *manual* operations (like certain classes of collating) should be the result of similar tests under fixed working conditions and approved methods.

The resulting standards will necessarily vary with the quality and complexity of finished work required. A two-color offset or stencil job, for example, not only requires a double run through the

REGISTER OF WORK RECEIVED

FIGURE 8

PAGE No. _____

[illegible]

press but requires extra time and care in inking and adjusting to assure proper color impression and registry. (Hence, two-color duplicating is rarely justified in Government.) An offset job which includes halftone illustrations must have more careful attention than one which does not. A stencil job which includes fine-line stylus work or large areas of solid color, or which has to be run on glossy paper, requires more time than ordinary stencil work. By any process, a job that has to be perfectly clean throughout takes more time than one in which legibility is the only consideration.

While there is, therefore, no such thing as a set of generally applicable standards for production-control purposes, the study of agency plants upon which we have based this bulletin suggests the following general levels of production to be reasonable for common classes of work, in job lots of average quantity, and with average make-ready and delay allowances:

<i>Type of operation or process</i>	<i>Daily production per operator (8 hours)</i>
Mimeograph-----	25,000 impressions
Spirit (hectograph)-----	20,000 "
Offset-----	25,000 "
*Offset plate making-----	90 plates
Ozalid-----	1,500 (8" x 10½") prints
Photostat-----	750 (18" x 24") prints
Embossing addressing plates--	250 plates (3-line)
Addressing-----	20,000 impressions
Collating (manual)-----	16,000 pages

*Does not include photographing and developing negatives. Where these steps were combined with plate making proper, an average of about three plates an hour was found to be a common rate; but the rate varies widely, depending on size, complexity and quality of original copy.

These figures should be viewed as general averages which many plants can exceed. As rough averages, the figures may be a helpful starting point for shops that have not yet developed their own standards, but in no event should they be treated as fixed potentials.

Evaluating Output

For monthly analysis of plant performance, the kind of form illustrated in figure 9 has served effectively in several agencies. This report summarizes the total number of work-units produced by each process or operation, the potential capacity, man-days used, number of jobs and pages handled, the kind and amount of work farmed out, and the general status of work. Again, the pattern of the report is indicative only. Some agencies need a more detailed break-down; others a less detailed one. In

any event, the specific processes to be shown on the report will vary from shop to shop.

The data concerning the number of requisitions on hand at the beginning of the month, the number received and completed during the month, the number pending at the end of the month, and the number of jobs processed during the month are secured from the Register of Work Received (fig. 8). The other data, on staff time and actual production, are taken from the monthly records of daily production (fig. 4), or they may be summarized directly from operators' daily tallies.

Making a monthly production summary is itself an act which, by requiring the assembly of significant facts, can hardly fail to improve the perspective of the supervisor making the report. While this regularly enforced circumspection is helpful in its own right, the main values of such reporting arise from the critical comparison of repeated reports and the careful analysis of trends by the shop supervisor and his superiors. Are man- and machine-hours being fully utilized? Does output compare favorably with that of other plants? Does the over-all trend of workload suggest unbalanced manpower or machine complement? Are some processes being overused? Has work scheduling been realistic or has production fallen behind schedule? If so, in what processes? These are but a few of the many questions that a review of the report may raise.

Quality Control

Efforts toward effective management obviously are not good enough if they do not assure a finished product that meets quality requirements.

Several inspection measures ordinarily are taken to assure that such requirements are met. Many supervisors examine and approve initial machine impressions before permitting any long-run job to proceed. Spot checks of work in process may be made in accordance with the skill and dependability of individual operators, or as unusual jobs may demand. A formal inspection of each completed job, however, is usually the most effective basis for assuring a consistently high level of quality throughout the shop. Inspection of every job, of course, does not mean looking at every copy; usually a few well-selected samples out of each job are enough. Every operator should be aware that his work will be subjected to such inspection and that volume alone is not the object.

MONTHLY PRODUCTION SUMMARY

DUPLICATING AND DISTRIBUTION

For month of _____, 19____

				LAST MONTH	NUMBER OF REQUISITIONS		THIS MONTH	
Positions allocated.....					On hand beginning of month.....			
Vacancies (end of month).....					Received during month.....			
Total pay roll (end of month).....					Completed during month.....			
Total impressions run in shop.....					Pending at end of month.....			
Impressions run on contract.....					Under 10 days.....			
Total impressions let out on contract.....					10-30 days.....			
					Over 30 days.....			

PROCESS	MAN- HOURS	JOBS PROCESSED	PAGES OR MASTERS	ACTUAL OUTPUT (in units)	POTENTIAL OUTPUT (in units)	WORK DONE OUTSIDE (units)	WORK BEHIND SCHEDULE	
							JOBS	UNITS OF WORK
MANAGEMENT AND INDIRECT								
Supervision.....		X X X X	X X X X	X X X X	X X X X	X X X X	X X X X	X X X X
Clerical.....		X X X X	X X X X	X X X X	X X X X	X X X X	X X X X	X X X X
Other.....		X X X X	X X X X	X X X X	X X X X	X X X X	X X X X	X X X X
SUBTOTAL.....		X X X X	X X X X	X X X X	X X X X	X X X X	X X X X	X X X X
DIRECT PRODUCTION:								
COPY PREPARATION:								
Stencil (unit=1 stencil).....			X X X X					
D. I. Offset plate (unit=1 plate).....			X X X X					
Vari-type (unit=1 page, 8×10½).....			X X X X					
PLATEMAKING (unit=1 photo-offset plate).....			X X X X					
PRESSWORK (unit=1 impression): *								
Hectograph.....								
Stencil.....								
Offset (up to 11½×18).....								
Offset (14×20 and over).....								
PHOTO-PRINT (unit=1 print):								
Contact print.....								
Camera print.....								
FINISHING:								
Assembly (unit=1 sheet).....			X X X X					
Folding (unit=1 sheet).....			X X X X					
Stitching (unit=1 set).....								
Padding (unit=1 sheet).....			X X X X					
Punching (unit=1 sheet).....			X X X X					
Cutting (unit=1 sheet).....			X X X X					
DISTRIBUTION:								
Embossing (unit=1 plate).....			X X X X					
Addressing (unit=1 impression): *			X X X X					
Inserting and sealing (unit=1 envelope).....								
Wrapping (unit=1 pkg.).....								
OTHER.....								
SUBTOTAL.....			X X X X	X X X X	X X X X	X X X X	X X X X	X X X X
ANNUAL AND SICK LEAVE.....		X X X X	X X X X	X X X X	X X X X	X X X X	X X X X	X X X X
GRAND TOTAL.....		X X X X	X X X X	X X X X	X X X X	X X X X	X X X X	X X X X
TIME CHARGEABLE TO PLANT.....		X X X X	X X X X	X X X X	X X X X	X X X X	X X X X	X X X X
TOTAL HOURS AVAILABLE.....		X X X X	X X X X	X X X X	X X X X	X X X X	X X X X	X X X X

*Total impressions=Number of masters × number of copies.

Formal inspection should cover such aspects as the grade, weight, and color of paper used, legibility and registration of impression, adequacy of collating, stitching, and punching. Although definite descriptive standards cannot be maintained for every feature that may have a bearing on quality, standards covering the main features of the major classes of work should be made known to the workers concerned. Accordingly, specimen copies illustrating various degrees of excellence for each process and class of work should be kept constantly before the workers. In fact, exhibiting samples of work produced in the shop itself can serve not only to illustrate standards of quality but to give recognition and stimulate competition among the workers.

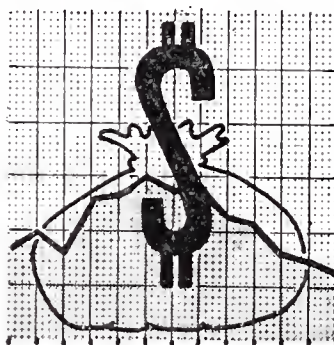
Inspection, then, should be based on the specifications of each requisition as interpreted in the light of standards made known to the staff. Completion of inspection should be attested by entry of the inspector's initials in an appropriate space on the job copy of the requisition form.

In establishing and interpreting qualitative production standards, the relatively new technique of statistical quality control can be used much as work measurement is used in establishing quantitative production standards. Statistical quality control has two major advantages: (1) by the systematic use of statistical sampling, it reduces the amount and cost of inspection needed; and (2) by the use of control charts, it lets management know promptly when a process is out of control (that is, when results are not within the tolerance limits previously set as part of the quality standards).⁶

It is often a good idea to have inspection done by a supervisor, so that any conditions needing management attention can be readily recognized and promptly acted upon; for it is generally agreed that findings of quality analysis can lead into every phase of plant operation, pointing up deficiencies which might otherwise escape attention.

⁶ For a brief general discussion of statistical quality control, see *A Technique for Controlling Quality*, PUBLIC ADMINISTRATION REVIEW, spring 1948.

VII. ARE COSTS UNDER CONTROL?⁷



A strictly dollars-and-cents appraisal of duplicating service may miss important operating considerations entirely. To rely on cost information alone as a measure of how well your duplicating needs are being met, therefore, would be a mistake. Nevertheless, cost finding can give you what probably is as near a single index of general efficiency as you can get; for a cost report should be a thumbnail consolidation of other measurements—with a dollar sign attached.

Cost control relates accomplishment to cost by drawing key facts from existing records—expenditure records, material and supply records, and production records. Yet, it does not have to be of high precision or elaborate detail to be a real aid to management. Nor does the usefulness of cost finding for the duplicating shop depend upon its being a part of a formal agency-wide cost-accounting system—however much more desirable that may be. Cost estimates which may not be precise enough for strict accounting purposes can still be satisfactory for the control and comparison purposes that we are concerned with here. In fact, some kind of cost finding—or plain guessing in the absence of cost finding—simply has to be done as a basis for many of the decisions that have to be made about any duplicating service.

The general guide lines offered here are drawn from practices found in agency duplicating shops which have had some success in finding and controlling their costs. Much remains to be done, however, before anyone can say with assurance just what cost calculations are the least that should be expected in the various classes of shops. Let us make it clear, therefore, that in pointing out the need to control and compare costs in agency duplicating we are not trying to hand you a set of cost-accounting principles, and we are not trying to tell you what specific cost-finding system should be used in your plant.

⁷ As this is written a joint study is under way by the General Accounting Office, the Treasury Department, and the Bureau of the Budget to find out what improvements should be made generally in Federal accounting methods. That study may lead to more positive guidance in the development of cost-accounting procedures for duplicating shops as well as other common agency services.

In its budget-training conferences the Bureau of the Budget has found it useful to recognize several different kinds of cost-finding activity. *Cost accounting*, as defined by the Municipal Finance Officers Association of the United States and Canada, is "that method of accounting which provides for searching out and recording all of the elements of cost incurred to attain a purpose, to carry on an activity or operation, or to complete a unit of work of a specific job." The term *cost reporting* has been applied to cost finding done

on the basis of memoranda which only approximate the general financial accounts and which may disregard certain hard-to-determine cost elements. The term *cost ascertainment* has been applied to statistical-sampling methods of cost finding in the absence of regular and complete cost accounts. *Expenditure accounting* refers to the practice, common in the Federal Government, of recording financial charges according to the activities, purposes, or "objects" paid for in a given time period, without necessarily relating those expenses to any unit of production or accomplishment realized in the same (or any other) period. Such accounting alone obviously does not constitute cost finding, but it provides facts which, if supplemented by materials-consumption and production (work-measurement) data, can result in cost finding. *Work measurement*, by any of several methods, establishes a relationship between employee time expended and the amount of work done.

Why Control Costs?

Aside from any regular cost reports for the Joint Committee on Printing,⁸ your shop may not need to do a complete cost analysis at fixed intervals, monthly or even quarterly. If regular cost keeping is not done, however, a general "cost ascertainment" is necessary occasionally.

Together with the monthly production summary, cost reports enable you to compare output and expense for different periods, different processes, and different plants. Such reports enable you to compare costs for different levels of production and help you to run down costs that are out of line. They should tell you when work methods and standards need attention. They help tell you whether you should have a shop or not and what processes within the shop are feasible. Those and a good many other specific advantages are included in the third and probably most important of the following three main purposes of cost control in duplicating services. In broad terms, the cost report should—

1. Assure fair service charges in plants operating on a reimbursable basis;
2. Help in budget planning and execution;
3. Provide a basis for broad management appraisal, control, and direction.

After touching upon some of the kinds and sources of cost data needed, we will come back briefly to those three main purposes in looking at how the data should be put to work.

What Cost Data Are Needed?

How simple can cost finding be and still serve its purpose? How can nonaccounting people, if necessary, derive the cost facts which they need for control and planning but which the general expenditure accounts do not give?

The specific cost data to be assembled depend upon—

1. The size and complexity of shop operation;
2. Current reporting requirements of the Joint Committee on Printing;
3. Means of financing the operation.

One-man installations—if not using processes or equipment calling for regular reports to the Joint Committee—may not need detailed cost reports;

⁸ *Regulations of the Joint Committee on Printing, Congress of the United States, relative to Government Printing and Binding, July 1, 1948.*

the necessary record keeping and calculation may cost more than the results are worth. Instead, it may be enough for such shops to report the direct costs of personnel and materials (particularly paper). For comparison of different time periods, these direct costs are highly indicative in themselves; and, if needed for comparison with other shops, an estimate to cover indirect and overhead expense can be added as a flat percentage of the direct costs. Such an allowance for fixed costs (which, like rent and depreciation, are relatively constant regardless of production volume) may be calculated once and applied repeatedly as long as facilities and general operating conditions remain about the same.

In larger and more complex plants, more detailed cost reporting may be not only worthwhile but required by the Joint Committee.

If your shop is financed on a regular appropriation basis, the cost classification and the minimum cost-data requirements may be those of any JCP reports required.⁹ To the direct costs of *labor* and *material* it is desirable to add estimates for specific administrative and indirect costs, such as those for *supervision, equipment depreciation* and *maintenance, space, and utilities*. The form in which those costs are reported for internal control and budget purposes may vary widely among different shops. At least occasionally, however, they should be broken down to show unit costs by process. On that basis, you can tell, for example, how much a regular size page of stencil duplicating is costing you compared with the same size page of offset work; and you can tell how your cost per page, by any process, compares with that of other shops, either Government or commercial, using the same process.

If your shop is financed on a reimbursable basis (by a revolving working capital fund or otherwise) its cost records, in addition to being adequate for required JCP reports, should always provide the data for accurate unit-cost estimates by process. Otherwise the shop probably will either lose money consistently on services provided or else overcharge its customers and misjudge its own efficiency accordingly.

⁹ As of July 1, 1948, the nature of the quarterly cost information required of Federal duplicating shops coming under the JCP definition for printing plants varied according to the nature and limitations of the processes and equipment used. On that basis, two classes of plants were recognized, with the class A plants being asked for less detailed information than the class B plants. See the *Regulations of the Joint Committee on Printing, Congress of the United States, relative to Printing and Binding, July 1, 1948.*

Sources of Data

Usually the same classification of processes and operations used in the monthly production report (see fig. 9) can serve also in compiling unit-process costs. The production report, as we have shown, provides for a summary of man-days chargeable to each process. By applying appropriate salary rates and prorating management and indirect salary costs among the direct production processes, personnel costs, by process and by unit of output, can be fairly simply derived.

Charges for paper and other direct production materials issued and recorded by process (as discussed in ch. V under *Material Issuance Control*) can be picked up with little difficulty for cost-reporting purposes, and general office supplies, like other administrative costs, can be prorated.

To the extent that shop employees repair and maintain their own equipment, the cost of maintenance will be included in salary and supply charges. To the extent that maintenance is provided by outside service establishments, the costs can ordinarily be picked up from appropriate vouchers or voucher accounts. The more important equipment cost, depreciation, is customarily charged at a fixed percentage of current inventory value. Rates from 6 to 12 percent a year are common in industry.¹⁰ On the basis of normal production rates, equipment maintenance and depreciation charges can, then, be projected into unit costs as necessary.

The forms or memoranda used in picking up and combining the different cost data, and the make-up of the resulting cost reports vary according to circumstances. If such records are not actually subsidiary to the general agency accounting system, however, they should at least be reconcilable with the general accounts.

How Is Cost Information Put To Work?

As already mentioned, cost reports should contribute in a very tangible way to pricing, budgeting, and management-control purposes.

ESTABLISHING SERVICE CHARGES. In reimbursable shops, charges for service should not only be in accordance with the cost calculations reported, but should be shown directly in a published price list, also based upon the latest cost analysis. Although no price list can cover all conceivable orders, one that is well organized and based on actual cost experience can make charges entirely predictable for

¹⁰ As this is written, depreciation in agency plants is commonly charged at the rate of 3 percent per quarter (a figure stipulated for one of the JCP quarterly reports).

routine work, and can reduce the area of customer guesswork and shop calculation on special jobs. Such an arrangement not only simplifies estimating and billing procedures but makes for good customer relations. The current price schedule issued by the Field Service of the Government Printing Office is an example of a quite complete price list for a large reimbursable shop.

Even shops that do not operate on a reimbursable basis can profit by a simple price-list type of cost schedule which can be circulated to the offices using the service, to help those offices plan and requisition their work in terms of processes that are economical for the quantities needed. However, if relative unit-cost estimates for the different processes are included in a general chart (like the *Guide to Reproduction Methods*, exhibit B), a price list for this purpose alone should not be needed.

BUDGETING. In budget preparation, unit costs and reasonable estimates of work to be produced should combine to give a dependable appropriation estimate, in terms of the whole shop and of each major process. With a continuously tested cost experience, the translation of required output into required funds for personal services, materials and supplies, equipment, machine repairs, and so on, should be a matter of simple arithmetic. In budget execution, the same cost index should provide a yardstick for measuring conformance to the forecast. In addition, it should provide a factual basis for any midterm budget adjustments that may be necessary.

In fact, the same unit-cost information that helps determine what processes should be maintained in a shop, can be used to swing customer demand within the agency to the more economical processes, both as a means of paring down original budget requests and as a means of living within a tight appropriation.

APPRAISING AND CONTROLLING. The mere making of cost reports may make shop workers more cost-conscious, more careful and less wasteful than they might otherwise be. In any event, even the simplest cost reporting system should show management quickly any important change in value received per dollar expended. Interpreted in the light of regular production reports, the cost reports should tell management (1) whether supervisory improvement is needed, (2) whether consideration should be given to changes of process, equipment or sources of service, or (3) whether special management analysis is needed to more accurately identify weaknesses and determine specific action needed.

Cost control should chart the pulse of the shop.

VIII. MANAGEMENT CHECK LIST FOR DUPLICATING ACTIVITY



We have emphasized that, whatever your agency's means of getting written work reproduced, you can ill afford not to take stock from time to time to be sure that you are getting a maximum of needed service at minimum cost. If the agency has its own facilities, do the facilities pay their way, or could you have the necessary duplicating done more economically outside? Even though some duplicating processes may be so justified, can all of them be? Beyond the question of justification, are reasonable standards of quality and efficiency being met?

Those are the broad questions that you should answer. But answers that broad do not come ready made. You can piece them together only from the answers to a number of specific questions—answers that you may find by such means as we have suggested in earlier pages. In summary, we list some of the more important questions here in the form of a check list which you can follow in the actual process of fact-finding and evaluation.

GENERAL

NOTES

1. Is the operation of agency duplicating facilities (including field installations) warranted by program requirements for quality, quantity, speed of service, procedural tie-in, security treatment, or by comparative costs (as against services available commercially or from other Government sources)? Has the decision to operate or not operate such facilities been reaffirmed in the light of current conditions?

2. Are facilities so located in the organization as to permit coordinated service and sound technical direction? Are there scattered installations which might operate more effectively if wholly or partly consolidated? Would centralization of authority (with or without centralized location of all equipment) permit fuller utilization of personnel or equipment and better technical supervision?

3. Does organization provide for adequate coordination with such related activities as forms and publications control, drafting or graphics, procurement and supply, addressing and distribution?

4. Are administrative reports adequate to show relative efficiency and economy of operations? Are these reports analyzed at the proper level of administration? Is corrective action taken as the reports show it to be needed?

5. Are responsibility and authority at the different levels clear-cut and logically placed? Is authority graduated so that only matters of broad importance require attention above the level of plant supervision?

6. Is there an effective and coordinated procedure for deciding whether or not materials to be reproduced are essential to the program?

7. Is proper analysis of jobs made by staff technically equipped to determine what work may be best produced by printing press rather than duplicator, and to determine the specific process to be used for each duplicating job—in terms of the original copy available, number of impressions required, necessary page size, writing quality of finished prints, legibility and life of copies, speed, and cost of process? Is periodic study of requisitions made to verify the answers to this question?

8. Is the plant supervisor free to question the quantity or process specification which he receives?

MANPOWER

9. Is qualified supervision available for the technical operations involved? In smaller units are working supervisors used? Is supervisory responsibility clear cut, and are areas of direct supervision restricted to common or closely related processes? Does supervisory responsibility cover all phases of management interest? Is supervision so close that it smothers initiative and interest? Is recognition given for superior work and constructive suggestions?

10. Are skill and aptitude requirements properly recognized as a basis for classifying, hiring, placing, work grouping, and training? Has a real job analysis been made in the shop?

11. Is provision made for proper training? Are supervisors and staff kept up to date on technical developments? Have manufacturers' representatives been asked to appraise the technical performance of staff? Is adequate training given to those outside the shop who must prepare stencils or other masters for use in the shop?

12. Are worker classifications in line with those for similar activities in other parts of the agency, and in other agencies? Are job descriptions sufficiently broad to permit staff assignment on various operations as work load fluctuates?

13. Are proper records maintained to show individual performance? Have production standards been used to determine the number of operators needed for each process and operation? How recently have the standards been checked for validity? What is the variation between potential and actual output? Are records such that the personal-service element of cost can be allocated to process or operation?

EQUIPMENT

14. Has due consideration been given to the makes and models of machines used? Has machine complement been revised from time to time as improved models have been introduced? Are all essential accessories provided? Are unneeded accessories on hand?

15. Are adequate production records kept for developing standards and estimating potential output? Have standards been used to determine how many of each make and model of machine required? Have

potential workloads been carefully estimated as a means of setting economic limits of agency reproduction?

16. Are records adequate for determining the degree of machine utilization? Are the records analyzed periodically to see: (a) If revisions in machine complements are needed, (b) if certain operations should be farmed out, or (c) if quantities beyond an economic limit should be farmed out?

17. Are machine-operation records adequate for securing unit costs in each process? Are these records in sufficient detail to identify specific deficiencies and point up discrepancies among comparable processes?

18. Do maintenance facilities permit dependable and economical machine performance? Is a record kept of break-down time for each machine? Are the costs of repairs that are paid for by voucher reviewed from time to time? Is the break-down record studied periodically to evaluate maintenance service and to find the reasons for any undue production loss caused by mechanical failure? Have alternative sources of repair service been considered? Does the shop take full advantage of "free" service covered by the purchase price of equipment?

19. Does the physical arrangement of the plant make for good service and efficient operation (distance from ordering units, space, elevator service, floor loads, etc.)? Is equipment laid out for straight-line production flow? Are operations which are related or which require common skills well grouped?

MATERIALS AND SUPPLIES

20. Is responsibility properly placed for determining the kind and amount of supplies to be stocked, and for replenishing stock? Are duplicator supplies maintained by the general stock room and issued to the duplicating shop in work lots, or does the shop maintain and control its own supplies? Are replenishment requisitions administratively approved? Are the types of stocked materials and supplies consistent with the end products required? Do any of the stocked items indicate the performance of work for which the plant is not suited? To what extent have materials and supplies been standardized? Is quality of work reviewed regularly to see if the right materials are being used?

21. What is the normal stock-supply period? Is a record kept of stock on hand, receipts and all individual issues for operating use? Is this record reviewed to locate and dispose of slow-moving or dead items?

22. Are supplies located for efficient movement to machines? Do operators have access to the stock room or to working supplies made available in the shop? Do the arrangement and operation of supply facilities help to keep down spoilage and other waste?

23. Are stock issues checked against processed output as a measure of waste? How often is a paper-utilization report made? Are waste receptacles checked periodically?

24. Are supply-cost records adequate for securing the unit costs of end products? Are these unit costs analyzed regularly as a clue to the soundness of supply practices?

25. Are suitable production and work-assignment records maintained for effective scheduling of work? Are regular, recurring jobs scheduled well in advance? Are blanket requisitions used for regular, recurring jobs to simplify clearance and paper work? Are advance arrangements made so that long-run stock-replenishing jobs can be run to fill in and stabilize, rather than disturb, daily production requirements?

26. Is a log, or register, kept so that the lapse can be readily determined between receipt of requisition and delivery of finished work? If not, have requisitions for typical periods been examined to check on this time lag?

27. Would more effective choice among alternative processes permit improved work scheduling? Is a process-selection chart used by the requisitioning offices, the control unit, and the plant supervisor? Is the plant supervisor free to suggest alternative processes for better work scheduling?

28. Is the work-load trend analyzed with a view to leveling out production requirements? Are peak loads minimized by scheduling and outside contracting?

29. Are the records that are kept on the assignment and status of jobs adequate to assure chronological handling through the shop, and to permit prompt replies to inquiries from ordering units?

30. Are periodic inspections made at work stations in the plant to determine the current status of orders? Is immediate follow-up made on overdue orders?

31. Have standards of potential production been established for each machine, process, and operation? Are records of actual production kept in comparable terms, and in such form as to simplify reviewing and reporting? Do reports, prepared periodically to reflect potential versus actual production, for each operator, machine, and process, provide a basis for evaluating efficiency and machine utilization? Are standards periodically checked against experience? Are standards compared with those of other agency and commercial shops?

32. Is duplicating plate, negative, stencil, or other master impression saved when a rerun is probable? Are these properly catalogued and filed? Are files periodically purged? Is storage space loaded with masters not likely to be used again? Have specific rules been established for deciding when or how long to keep masters on file?

33. Are job overruns reviewed periodically to check operator and machine efficiency?

34. Is finished work regularly inspected for quality? Are unusual set-ups inspected before production begins? Is inspection effectively related to quality standards (statistically or otherwise)? Is defective work traced to its cause (i. e., machine operation, mechanical failure, inferior supplies, nonstandard accessories, etc.)? Are steps taken promptly to correct deficiencies? Is recognition given for superior work?

COST CONTROL

35. Are production and supply records maintained by process so that unit costs may be determined? Do costs include proper allowances for

equipment depreciation, maintenance, administrative overhead, and other indirect charges?

36. Are items of expense so classified that cost elements may be compared with those in other plants? Are such comparisons made periodically? Are variations in comparative unit costs used to point up management weaknesses?

37. Are cost reports used to facilitate budget preparation and execution?

38. Are service charges properly related to the cost analyses? Is a detailed price list, based on actual cost, available to the users of the service?

Appendix

THE PRINTING AND DUPLICATING PROCESSES

For you who may have either a working interest in the output of a duplicating shop or some general managerial responsibility relating to it, but who may be familiar with only one or two of the major duplicating processes, a brief nontechnical explanation of the principal processes may be helpful. However, since the difference between what is commonly called duplicating, reproduction, or processing and what is commonly called printing is not altogether a sharp one, let us preface that explanation by a few highlights on the traditional printing methods.

A Basis for Comparison—Traditional Printing Methods

Traditionally the printing and publishing industry uses three basic reproduction processes. These are (1) letterpress, or relief printing; (2) gravure, or intaglio printing; and (3) lithography, or planographic printing (including offset printing).

Seldom does a single print shop use all three of these processes. Most job shops use two or more kinds of letterpress. Quite a few specialize in offset printing, now the most common version of lithography; and a large and still growing number supplement their letterpress work with offset printing. Shops doing gravure work are highly specialized and relatively scarce.

The bindery equipment used in conjunction with the printing processes also is quite variable. A general-purpose paper cutter, a stitcher (stapling machine), a punching machine, folding and gathering tables, and collating racks are common to nearly all job-printing shops. Great differences are found, however, in the amount, kind, size, capacity, and complexity of such equipment. The assortment of equipment found in very small job-printing plants often is comparable to that found in relatively large duplicating shops.

In addition to the job shops, doing a variety of everyday printing and publishing, are the specialty houses, each concentrating in the large-scale fabrication of one class or a few related classes of more or less standardized printing products. For example, there are bag and box printers, novelty printers, ticket makers, legal brief printers, check and security printers, label printers, specialty forms manufacturers, calendar and greeting-card printers, book and magazine printers, and, of course, newspaper printers. In some instances the actual printing mechanism is only a small part of a massive machine designed to carry out a long series of cutting, folding, scoring, perforating, punching, embossing, forming, assembling, past-

ing, and stitching or riveting operations, in addition to printing; but the printing operation itself is nearly always one of the three basic processes explained below.

Letterpress Printing

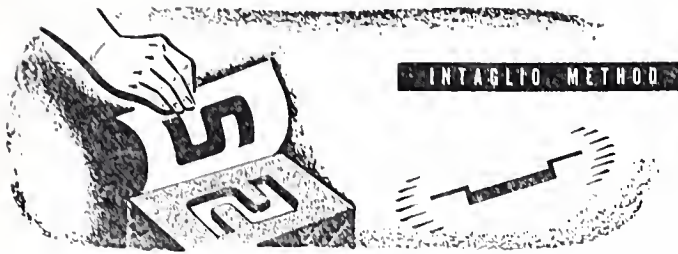


Most printing is done by the letterpress (relief, type-set or type-high) process, although the printing presses that account for the big volume of output are a far cry from the small simple presses from which the process took its name. In the letterpress method, reproduction is accomplished by the transfer of ink from a raised (or relief) image to the paper or other surface on which the copy is desired. The raised image is ordinarily made up of (1) metal type characters locked in a frame (or chase), (2) a zinc or copper photoengraving (cut), (3) a solid type-metal plate (stereotype) which has been cast from a papier mâché matrix (mat) made from an original type-set or photo-engraved form, or (4) a hard surfaced casting (electrotype) similar to a stereotype except that it is of harder metal and is electroplated for long wear.

The presses which print from such forms are of widely varying design and size. There are platen presses (both the type form and the impression surface being flat), horizontal and vertical cylinder presses (type form being flat and impression surface cylindrical), rotary presses (both type plate and impression surface being cylindrical), and numerous special adaptations of these basic designs. These machines range from letter-size platen presses to the giant rotary web and web-perfecting presses on which metropolitan newspapers are produced. In between these extremes, the great volume of printing is done on flat-bed cylinder presses, the smallest common size of which (a pony press) prints a sheet 17 by 22 inches—an area four times the ordinary letter-size sheet most frequently turned out in duplicating shops.

Obviously, however, the typesetting and casting machinery (Linotype, Intertype, or Linograph composing machines, Monotype and logotype casters, stereotype casting equipment, and so on) are as important a part of the letterpress method as the presses themselves. Here is one of the principal distinctions between the printing industry and what might be called the duplicating industry.

Gravure Printing



In gravure, or intaglio, printing (engraving, photogravure, rotogravure) reproduction is accomplished by the transfer of ink from a recessed image—an image that has been engraved or etched into the surface of a metal plate. Among the old and well-known classes of gravure are the copperplate engravings used to produce formal stationery and the steel engravings used for paper money. Though yielding fine results, gravure is slow and costly. The nearest it comes to a mass-production method is in the photogravure and rotogravure adaptations, familiar in the Sunday supplements of a few newspapers. In no event is gravure a means of turning out run-of-the-mill work.

Lithographic or Planographic Printing



Except for comparable bindery practices, it is in the chief adaptation of lithography that printing shops and duplicating shops most often come to common ground.

In the lithographic method the transfer of ink is from an image that is neither raised nor recessed but is part of an almost perfectly plane surface. Hence, the term "planograph." The method is based simply on the affinity of oil for oil and the lack of affinity of oil for water. Traditionally the image transfer was accomplished by (1) drawing a negative (reverse) image with a greasy lithographic crayon upon a flat, porous limestone surface; (2) applying water, which adhered to all except the greasy crayoned areas of the surface; (3) applying an oil-base ink, which then adhered only to the grease-image; and (4) finally impressing a sheet of paper (or other material) upon the stone surface, so that the sheet received a positive copy of the inked image.

Essentially this method of direct lithography still is used for some classes of work (notably large billboard posters and long runs of multicolor labels).

However, it was the development of the offset variation—along with cheap, pliable, and workable substitutes for the stone printing surface, and photochemical and other simple means of imaging the substitute surfaces—that permitted fully mechanized presses to bring lithography down to everyday printing needs. Sheets of zinc (or aluminum) were grained to give them some of the porosity of limestone. Being thin and pliable, they could be readily curved for use on a fast-traveling cylindrical roller. Although zinc plates are still the most common surface for photo-offset lithography, various heavy, coated papers have been developed as still lower-cost substitutes for the lithographic stone. Upon some of the paper plates (direct-image plates) typing, handwriting,

tracing, or drawing can be done much as on any other paper (so long as a grease-base typewriter ribbon or ink is used) and the plate then put directly on the press with no photographic action necessary. Other paper plates are surfaced to receive the master image photographically just as zinc plates usually do. While most paper plates (either direct-image or photographic) are capable only of relatively short runs, at least one make of photographic paper plate—coated with a fine granular plastic—is intended to compete with metal plates in long-run work. A similar plastic plate is available for direct-image work but does not equal the photographic plate in length of run.

The steps in the offset process as used in the printing industry are approximately the same as those that we shall briefly explain below under the heading of *Duplicating Methods*. Offset work in the printing industry, however, is typified by long runs and multiple jobs (called gang runs) on large presses. On that basis, highly skilled camcramen, plate makers, and pressmen, using elaborate auxiliary equipment, can produce a range of finished work often beyond the economic limits of the smaller, less versatile offset facilities ordinarily available in agency duplicating shops.

Duplicating Methods

Unlike printing presses, most duplicating machines were designed originally to be used in general offices right along with other business machines. Quite often for the sake of efficiency, a small single-purpose duplicator can and should be installed as an integrated step in a continuous flow of paper-work procedure. Aside from such procedural use, duplicating machines often—probably too often—are scattered among general offices in the name of convenience.

As copy-preparing methods and equipment, and the duplicating machines themselves, have been developed toward greater versatility, however, the skill and knowledge required for good operation and good management of the equipment led to the now common practice of concentrating the work in general duplicating rooms. Well toward the front in that trend were the "letter shops"—the name commonly given to duplicating shops that serve the general public or the general business community rather than a single establishment.

Thus, duplicating shops, much like small machine shops, may be "captive" units of larger enterprises in any industry or they may be independent. Again like machine shops, however, duplicating, from the traditional horizontal or functional viewpoint, may be recognized as an industry in itself (or perhaps as a branch of the graphic arts industry, comparable to printing and publishing and photography).

Unlike printing, duplicating offers no simple and time-honored classification of basic processes. This relatively new industry has reached out and borrowed heavily from the printers, the photographers, and the die-stuff chemists. Its trade terminology is as hybrid in character as its processes.

Many duplicating shops—more outside the Government than in it—do make use of the letterpress, or relief, process in a very limited way, as represented by: (1) the office-rotary process, explained below; (2) addressing machines, included in some shops; (3) occasional proof presses, used for poster work or for display headings to be added to photo-offset copy; or (4) the familiar rubber stamp. The gravure process has no counterpart at all in duplicating shops. On the other hand, the lithographic process, as represented by offset printing, is a mainstay of the duplicating industry.

Going beyond the methods borrowed from the printers, the duplicating industry uses many other processes. Chief among these are stencil duplicating, hectograph duplicating, and—here is where classifications vary most widely—several photochemical processes. Among the photochemical processes, manufacturers' product names often offer the only means of naming a process precisely. Further, people in the trade disagree about questions, for example, of whether a process is really photographic if only an exposure frame, light, and developer (but no lens or camera) are used to reproduce an image on sensitized paper. Whether a process is "contact printing" or merely a contact form of "photo copying" depends upon whom you ask. In very sketchily explaining some of these processes, therefore, we shall lean toward the trade usages which appear to agree most closely with the dictionary meaning of any terms in question.

We do not intend the explanations, below, to be precise or complete in chemical or mechanical detail. We intend them only to bring out the distinguishing characteristics of each process.

Office Rotary Relief Process



More popular before the development of small, economical offset presses than at present, rotary-relief office duplicators (such as the Multigraph) still are feasible for certain kinds of work—such as imprinting local identification on previously printed general materials, printing ready-made envelopes, printing postal cards that require only a few lines of type, adding a few lines of necessary color printing to work run in standard black ink by another process, or printing small cards or forms that need to be scored or perforated—provided, of course, the demand for such work is frequent enough to justify the machine. For general work, however, the process is relatively inflexible; and although press-operating speed is high and efficient, the printing normally is done from type which has to be set by hand, a step long outmoded for commercial grades of text matter in the printing industry. Although the hand-setting process in this instance is considerably simplified by the T-shaped base of the type and the slotted type-holding construction of the printing cylinder, it nevertheless is a time-consuming method and one which limits the flexibility of type arrangement.

Hectograph Process

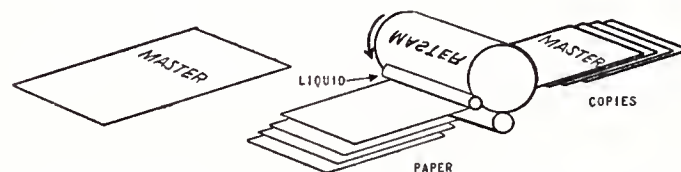
There are two different types of hectograph process: (1) the gelatin process and (2) the liquid or spirit process. The newer liquid process, being more efficient for general use, is rapidly replacing the gelatin.

In the *gelatin process*, the master copy is generally prepared by using a special typewriter ribbon or carbon paper impregnated with a strong aniline dye. Hand drawing or lettering may be done, however, with special inks or pencils. The image to be reproduced appears in positive form on the face of the master copy, just as it is to appear on duplicated copies. The character of the ink accounts for the simplicity of the process; but it also accounts for some fading of the

reproduced image, especially upon excessive exposure to sunlight.

The inked side of the master copy is impressed upon the gelatin surface of the duplicator. The gelatin absorbs ink from the master in the form of a reverse (or negative) image. Positive copies are obtained by impressing blank paper against the gelatin, which transfers the image to the paper by releasing a little ink each time a new sheet of paper is impressed. Single inking is the reason for the gradual lightening of copies on runs of more than 50. Ink not taken off by the copies gradually sinks into the gelatin, leaving the surface clear after an hour or so. The gelatine surface thus can be used over and over again.

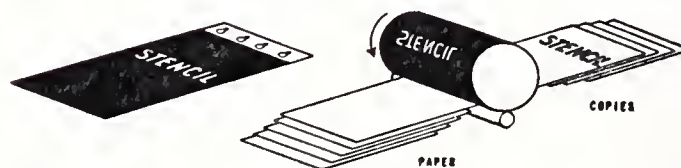
For the *liquid (or spirit) process* the master copy is prepared by typing or drawing upon paper which is backed by a face-up hectograph carbon sheet. The carbon transfers an image in reverse (or negative) to the back of the paper. The paper and carbon for preparing the original generally come in sets ready for insertion in the typewriter.



After preparation, the master copy is placed securely on a metal cylinder, with the inked image outward. Sheets of paper are fed under a moistening roller (so they will attract dye from the master) and thence over or under the revolving master cylinder, from which the inked image is transferred (in positive). The fluid used is an alcoholic mixture, accounting for the term *spirit process*. Each sheet of paper coming in contact with the master removes some of the carbon deposit, or dye, until the copies become too light to be legible. If the number of copies run at one time do not remove all the dye, the master can be saved and rerun at a future time. Ordinarily not more than about 150 clear, legible impressions are expected from one master, including any reruns made from it (although some manufacturers now are marketing hectograph carbon paper said to be good for three or four times that number of legible copies).

By either the gelatin or the liquid process, work in two or more colors can be reproduced in a single operation, simply by using various colors of ink, ribbon, pencil or carbon paper in preparing the master copy. For general work, however, purple is used almost exclusively because that dye will produce a larger number of legible copies than others.

Stencil Process

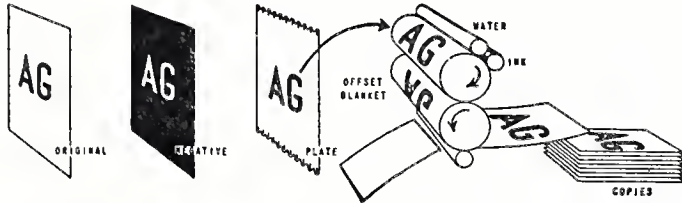


The master copy for the stencil-duplicating process (such as Mimeograph) is the stencil itself—a thin fibrous sheet covered on one side by a pliable, waxy coating through which ink will not pass. A typewriter, a hand stylus, or a die may be used to impress letters or other images upon the stencil with just sufficient force to penetrate the coating, so that ink may pass through.

The stencil is placed on the outside of a perforated and padded ink drum. As this cylinder is rotated, paper is fed between it and an impression roller. The resulting pressure

squeezes ink from the pad, through the openings of the stencil, and onto the paper, reproducing the desired image. A high-grade stencil, properly prepared, should be good for 5,000 or more serviceable impressions. If maximum use is not made of the stencil at one time, it may be cleaned and stored for future use. Work in two or more colors can be produced either by means of a separate stencil and separate press run for each color or by tedious spot-inking of the ink pad by hand. For Government purposes, however, the costs and inconveniences of color work by this process make it rarely feasible.

Offset Process



Two main types of masters are available for offset reproduction: (1) the direct-image plate (usually paper or plastic); and (2) the photographic plate (metal, plastic, or paper). The process of reproduction is identical for both direct-image and photographic after the plates have been prepared.

In *direct-image offset* work copy to be reproduced may be typed, drawn, or traced directly upon the surface of the master sheet with a grease-base ribbon, carbon paper or ink. Direct-image reproduction offers no possibility for enlargement or reduction in size of the work reproduced.

In *photo-offset* work copy to be reproduced may be typed, printed, drawn, or traced on any white paper by standard black typewriter ribbon or any black ink (though a carbon-paper ribbon or black India ink is preferable). Either line or halftone illustrations may be cut and pasted on the same sheet with the typed or hand-drawn copy in whatever arrangement may be desired. In fact, nearly any previously printed or reproduced pages, forms, charts, tables, maps or illustrations may be used (with or without change) as originals for photographic offset plates. The original copy is photographed in the same, enlarged, or reduced size, depending upon the desired size of the finished copy.

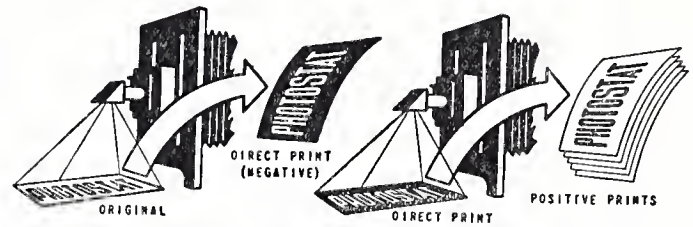
The photographic negative¹ is placed over the surface of a plate (usually a thin sheet of grained zinc, but may be plastic-coated or other specially prepared paper) which has been treated with a photo-sensitive, grease-attracting chemical. The plate, thus covered by the negative film, is exposed to an arc lamp. Light passes through the transparent areas of the negative, tending to fix the grease-receptive chemical on the exposed areas of the plate. The sensitizer is then washed off the remaining areas, leaving the plate with an image which will repel water and attract oily ink.

The offset press employs three cylinders—a plate or form cylinder, a rubber-blanket or offset cylinder, and an impression cylinder. The offset plate is clamped to the plate cylinder. This cylinder, as it revolves, rolls under a set of water and ink rollers. The image on the plate, which repels the water and accepts the grease-base ink, is transferred to the blanket cylinder (offset from plate to blanket). The blanket cylinder, in turn, impresses the image upon sheets of paper as they pass between the impression cylinder and the blanket cylinder. The plate image is positive, the blanket image is negative, and the final image on the paper again positive. Work in two

¹ If desired or if camera is not available, a special opaque stencil may be cut by typewriter or stylus and used instead of photographic film for typewritten matter or simple line drawings.

or more colors can be produced by means of a separate plate and separate press run for each color. The number of copies that can be run from one plate (from a few thousand to more than 25,000) depends upon the kind and quality of plate used.

Projection Photocopy



There are several varieties of projection photo-copying machines, ranging from small portable models to large stationary installations. The basic process is about the same in each of them. The master copy can be any document, drawing, book, or other object containing writing, lines, or pictures in any color or combination of colors, in any size up to the maximum of the equipment available.

The photostat machine, a widely used make of photo-copying equipment, consists chiefly of a camera with a magazine for holding a roll of sensitized paper. This assembly is mounted on a frame, to the front of which is attached a movable subject holder. The holder is charted with guide lines and numbers to aid in scaling the copy. The machine is equipped for mechanical focusing to the desired size of finished work, which may be enlarged, reduced or processed in the original size. The subject is photographed through a prism lens. The prism provides a means whereby the image, normally reversed by the lens, is again reversed and carried to the sensitized paper in its original position. The sensitized paper, after exposure, is processed through developing, fixing, and washing solutions and run through a drying machine. In some models this entire process is done within the machine, while for other models a darkroom is necessary for hand development. The first copy—though not a negative in the true sense of the word—is a reverse print; the image is white on a black ground. This "negative" is then photographed if normal black-on-white copies are wanted.

Contact Photocopy



There are many variations of the familiar blueprint method of reproduction whereby an image on a transparent or translucent sheet is transferred to a chemically sensitized sheet by placing the two sheets together, exposing to light (or other radiant energy) and then developing either in a chemical bath (wet process) or a chemical vapor (dry process). If vapor development is used (as in the ozalid process) the separate drying step is eliminated and curling of the finished prints avoided. Blueprints or blue-line prints, brownprints or brown-line prints (sepia or vandyke prints), black and white prints, and red-line prints are a few of the varieties of finished products possible by these processes. Ordinarily the same equipment, with changes of chemicals or of chemically treated paper, can be used to get various results. The equipment most commonly available for ordinary use, however, has been made more or less automatic at the expense of wide variability in the results.

Copy to be reproduced by these processes may be written, drawn or typed, so long as it is in sharp black on a transparent or translucent ground. Since the image is transferred by direct-contact exposure rather than by projection through a lens, no enlargement or reduction is possible; the image of the finished print is the same size as that of the original.

Comparative Advantages of Duplicating and of Printing

Modern duplicating equipment offers a wide range of results. You can get finished work of many kinds, many degrees of excellence and, by some processes, quantities formerly economical only in regular printing plants. By keeping on top of new developments and exercising resourcefulness in adapting and applying them, you can continually find ways to save time and expense both in duplicating itself and in the reporting and clerical procedures which often lead up to the duplicating process.

The economy of duplicating as compared with traditional printing, however, can seldom be taken for granted. Even a very small quantity in some classes of work can be produced more cheaply in the printing plant than in the usual duplicating shop.

Take, for example, a 12-page regulation directed toward only 50 or 60 agencies, with just a few copies needed by each—a total of only a few hundred copies. The document is straight text; no illustrations. Because it is of a permanent and highly authoritative nature, and because it will be given heavy and frequent reference use, the appearance of standard typography is appropriate. Such a document might be produced in some duplicating shops. By the use of special typewriters and paste-on or hand-drawn headings, an offset

plate could be made to give results comparing favorably in appearance with type-set work.

The cost, however, might not compare so favorably. To achieve the appearance of type-set work by use of special typewriters, each line ordinarily has to be typed once and then the characters and spaces in it counted, spaced and retyped to make the lines come out even (that is, to "justify" the right-hand margin). Often parts of a document must be retyped several times to make the copy fit the desired space; and corrections in the final copy must be made with great care. Such work adds up to a lot of time—and money. Setting straight text in printers' type is quite another matter. Although the pay rate of a Linotype operator is much higher than that of typists, his machine and his skill are such that he usually can set the same copy rapidly and finally the first time through—no letter-counting needed.

Aside from cost, the desired typographic quality would be somewhat less probable in the duplicating shop because such results are out of the ordinary for workers accustomed to handling routine type-script reproduction, whereas the same results are taken for granted in the printing plant, which works against a different scale of trade standards and draws upon well-established skills. Even though the printer might also run this job on an offset press (possibly producing all 12 pages on only two large plates), he most likely would first have it set in type and photograph a proof copy with which to make his offset plates.

The point is that only within routine classes and quantities of work is it ever safe to assume that the advantages of either printing or duplicating outweigh the advantages of the other; and many of the routine classes should be reconsidered from time to time in the light of all the steps that would go into their production by alternative means, and in the light of new developments in both the printing and duplicating industries.

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